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The Electrical Review

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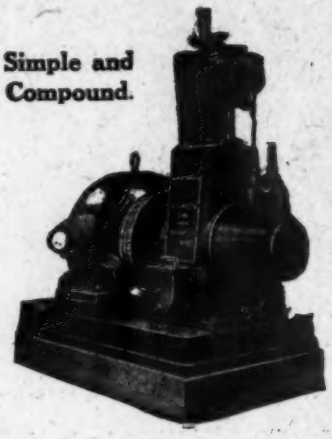

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THE THERMODYNAMIC EFFICIENCY OF POWER STATIONS.

THE public is periodically shocked by the announcement that the average power station converts only about 10 per cent. of the heat of the coal it uses into electrical energy. The inference is drawn that 90 per cent., more or less, of the coal burnt is wasted, and that something must be seriously wrong to allow of such a reckless squandering of our irreplaceable national assets. Now the average power-station engineer, who tabulates his costs in thousandths of a penny, resents the imputation of criminal negligence with regard to economy, as he knows that he is ceaselessly endeavouring to reduce his coal consumption by every means in his power. Yet he is confronted with the arithmetical fact that a consumption of, say, three lb. of 12,500-B.TH.U. coal per KW.-hour, means the use of 37,500 B.TH.U. in the coal to provide only 3,412 B.TH.U. of electrical energy. Thus, whether he likes it or not, he is compelled to admit that in such a case, the efficiency of his station would be little more than 9 per cent. Efficiencies, or rather inefficiencies, of this magnitude demand explanations, The fact that, viewed from this standpoint, there is comparatively little difference between the performances of different stations, tends to exonerate the engineers responsible for their operation. We do not mean to imply by this statement that a consumption of 2 lb. of coal per KW.-hour is not an enormously better performance than a consumption of 4 lb. per KW.-hour. It obviously is, yet the difference, even between such apparently widely separated operating results, is only the difference between the utilisation of 13·6 per cent. and 6·8 per cent. of the total heat in the coal. If then the operating engineer has comparatively so small a control over the proportion of the total heat of the coal which he can transform into electrical energy, where is the responsibility to be placed, or, as a more useful question, in what direction, if any, can greater efficiency be sought?

Before discussing this question, we may look at the matter from another point of view. It will be admitted that, under good operating conditions, boilers can be worked at 80 per cent. efficiency, or, in other words, 80 per cent. of the heat of the fuel can be got into the steam. Now, a turbine maker will guarantee a machine of large size to convert, say, 70 per cent. of the available heat in the steam into electrical energy at the switchboard. Thus we have an overall combined efficiency of boiler, turbine, and generator equal to 56 per cent. of the maximum possible. This is a very different matter from the 9 per cent. which we arrived at by a previous calculation, although, of course, the operation of a power station involves certain losses other than those directly concerned with the boilers and main generating units. Nevertheless, whatever we allow for such losses, we are faced with the question whether 9 per cent. or 50 per cent. more accurately denotes the real efficiency of the station.

The answer, of course, is that the first estimate takes into account the total heat that the fuel contains, while the second debits the plant with only the heat which is available for use. To illustrate how important this difference is, we will assume that a station using coal of a calorific value of 12,500 B.TH.U. per lb., and working with steam at 180 lb. gauge pressure and 100° F. superheat, is equipped with ideal boilers and turbo-generators which are theoretically perfect and entirely free from any sources of loss. Assuming that the turbines work with a 28-in. vacuum, this ideal and ideally-operated station will require about

0·948 lb. of coal per KW.-hour, so that only about 28·8 per cent. of the heat of the coal is transformed into work. As we have made the assumptions that the boilers turn the whole of the heat of the coal into steam, and that the turbines convert the whole of the available heat of the steam into electrical energy, we see that in no case could any actual station, working under the same thermodynamic conditions, attain an efficiency of 30 per cent. The trouble is that only a portion of the heat generated in the furnaces is really available for use, and the problem of the power engineer resolves itself into two parts; first, how to increase the proportion of the total heat which is available, and, secondly, how to increase the efficiency with which this available portion is utilised.

The availability of heat for conversion into work depends only upon the range of temperature through which the heated substance works, and it is superfluous to add that it is independent of the nature of the working substance. These facts should at once dispose of the foggy sort of idea held by many people, that the inefficiency of the steam plant is in some way due to the large latent heat of steam. If this were so, we could get better results by the use of a fluid with less latent heat. But if one imagines such a fluid, having all the properties of water, except that its latent heat at all temperatures is, say, one-half that of water, and then calculates the efficiency of the Rankine cycle with such a fluid for the working substance, he will at once see that it would have no advantages. The large latent heat of steam is, in fact, a benefit, in that it permits the bulk of the heat in steam to be taken in at the highest temperature of the cycle, and rejected at the lowest, so that most of the heat can work with the maximum temperature drop.

The real factor which limits the availability of the heat in the fuel is that our actual working substance, water, is only used between comparatively narrow limits of temperature. Our furnace temperature may readily be 2,500° F. higher than the condenser temperature, yet the temperature of saturated steam at 250 lb. per sq. in. is no more than about 300° F. above the same final temperature. It is the degradation of the furnace heat to the temperature of the steam, which increases so largely the quantity of heat required for a given amount of work, for even though none of the heat be lost, its power of doing work is vastly impaired by this irreversible temperature change. We cannot raise the working temperature of saturated steam very much because the pressure rises so rapidly with increase of temperature. At 200 lb. per sq. in. the absolute temperature is 842° F., while at 300 lb. per sq. in. it is no more than 877° F., so that a rise of not much more than 4 per cent. in temperature has brought about a 50 per cent. rise in pressure. In order to obtain a greater working range of temperature, the steam may, of course, be superheated, but we soon come to practical limits in this direction, and it must also be remembered that we do not gain the efficiency due to the full increase of temperature range, because only a comparatively small amount of the total heat enters the working substance at temperatures above that of the saturated steam.

In a paper on "Power Station Design in Relation to Thermal Efficiency," recently read before the I.M.E.A. Convention at Bradford, Mr. I. V. Robinson expresses the opinion that steam at 350 lb. per sq. in., and at a temperature of 700° F., is quite a practical proposition, and he thinks that in the near future we may see the use of steam at 500 lb. per sq. in. superheated to 750° F. He also considers that where cooling water at 55° F. is available, a 29-in. vacuum can be commercially maintained. Taking the above figures, we have for the two cases, available heat drops of about 469 B.TH.U. and 502 B.TH.U. respectively per pound of steam. Again assuming, as before, ideally perfect engines and boilers, we should utilise only 35·5 per cent. and 37·3 per cent. of the heat in the coal, in the respective cases. Thus we see that the gain in possible efficiency of a steam plant is not very great, even when going to the practical limit with regard to pressure and temperature. Moreover, the fact that our boilers and turbines are not theoretically perfect makes the gain from these high pressures and temperatures less than the theoretical amount, even supposing that the plant can be designed to perform thermodynamically as well under such conditions as under less strenuous ones. As a matter of fact, it is considerably more difficult to obtain high thermodynamic efficiency in a turbine which has to operate over a great range of steam pressure, than in one where there is less difference between the densities of the incoming and outgoing steam. Hence, in actual practice we stand to gain less by extreme pressures and temperatures than one might at first imagine. Supposing that a combined efficiency of boilers and turbo-generators of 65 per cent. can be reached, the thermodynamic efficiency of the station cannot then exceed about 25 per cent., even with the highest steam pressures and temperatures contemplated.

If any really considerable advance is to be made towards the better utilisation of the heat of the fuel in power stations, it will only be by some radical change from existing practice. The boiler-plant and the steam turbine are now almost as near practical perfection as they can be. The dominating factor in the efficiency of any heat engine is the temperature range of the working fluid, and with steam as our vehicle of heat, we seem to be well in sight of both ends of the possible temperature range. The suggestion to use mercury vapour for the high-temperature work and steam for the lower is attractive from the theoretical point of view, but it is impossible to say whether it will ever get beyond the laboratory stage. Nevertheless, if we are to use more of the heat of the fuel, we must, somehow or other, find a means of working with a higher initial temperature. The reciprocating gas engine is out of the question, in view of the magnitude of the generating units necessary in a modern station, and one is driven irresistibly to the idea of the gas turbine. The prospect, however, of obtaining prime movers of this type in the near future is exceedingly problematical, so great are the constructional difficulties. Meanwhile, all we can do is to operate available plant in the most economical manner, and remember that the scope for improvement in the working of the average power station is many times greater than the margin now left to the designers of boilers or turbines.

"Touchbutton House."

It is with much pleasure that we draw attention to the opening of Mr. H. H. Berry's "Electric House" in an article elsewhere in this issue, for it represents the realisation of a scheme which, unaware of his intentions, we advocated over a year ago.

The public are in sore need of help to cope with the difficulties of the times in the household; they are willing to pay for that help, but they do not know that it is available. The nation needs economy of fuel, labour, and food. "Touchbutton House" is a standing object-lesson of the ways and means by which the desired ends can be achieved; it has been patiently built up by Mr. Berry and his expert assistants, with the enthusiasm of the connoisseur combined with the skill and judgment of the engineer, at a fabulous cost. It will achieve fame on its merits, and we believe that by its establishment Mr. Berry has done a signal service not only to the electrical industries, but also to the public.

It may be argued by those who hold—we believe mistakenly—that art is only for the wealthy, that such an exhibition appeals to the wealthy alone. This is not true; the benefits of electrical appliances in the home can be enjoyed also by the less well-to-do, for the costly setting which Mr. Berry has provided for his display is not a necessary accompaniment of the all-electric system. He himself holds, in fact, that the system is applicable—on an economic basis—to the homes of the masses. "Central heating, and electrical topping-up" are the cardinal features of the system, for which economies of 50 per cent. in labour and 50 per cent. in cost are claimed. We hope that the Housing Authorities will give earnest attention to the matter, and that it will not be long before similar electric houses are established, on a more modest scale of course, in all parts of the country for the enlightenment of the public.

Trade Marks.

When we recall past history as affecting matters of copyright, and the mentality of some of our American cousins upon this particular point, it seems something like Nemesis overtaking our friends on the other side of the Atlantic to find them suffering from piracy in connection with trade marks. The offenders in this case are in South America, and the instance bears upon our recent editorial note on the recommendations of the Board of Trade Committee on the working of the Merchandise Marks Act with regard to international action. What has happened to the Americans in South America may well have—indeed in some instances has already—happened to British firms. A single firm in Rio de Janeiro has registered under its own name more than forty well-known American trade marks in the engineering trades. The moral, of course, is for all traders to register their trade marks in every country in the world. That, however, involves a good deal of trouble and expense, although neither should be shirked if the owner of a trade mark in his own country desires full protection for his goods. The difficulties in the way of international action with regard to trade marks are probably identical with those which have for so long stood in the way of international patents. To the ordinary observer it is not easy to see why there should be difficulties, because neither patentees nor owners of trade marks would expect to obtain their protection in foreign countries without payment, and it ought not to be beyond the wit of our politicians to arrange an international system which would automatically give protection in all civilised countries, by registration of the patent or trade mark in the country of origin of the applicant. In the business interests of the world some co-ordination of these laws ought to be a first consideration of Governments in order to put an end to the unscrupulous piracy now going on. Only a few days ago we heard it stated in public that the biggest enemies of the international patent were patent agents, because they see in it a reduction of their fees. We will not give the name of the gentleman who made this allegation, or the Institute of Chartered Patent Agents might start an action for libel, and at the same time endanger the goodwill between us and the Allied country to which this leading man of industrial science belongs. Certainly, however, the question of international action with regard to trade marks might be followed up more closely at once, as it is not encompassed by matters affecting priority, &c., as are patents. The Board of Trade Committee dealt with the difficulty to some extent, but did not get much further than a suggestion, and the efforts which have been made at International Conferences to effect greater uniformity of laws and procedure in the various countries should be energetically continued. Unhappily, the powers that be are too much engrossed in other matters to give attention to anything that will help trade, and the only advice we can give to holders of British trade marks meanwhile is to register them all over the world if they do not wish to see goods other than their own bearing the same trade mark and competing with them on the basis of the reputation they themselves have established.

Engineering Wages.

It has been understood for some months past that the engineering trade unions intended that when their fusion into one big union became an accomplished fact their united influence and strength would be brought to bear upon the question of wages. The claim was duly lodged asking for an advance of sixpence per hour, the request being based upon the increase in the cost of living since the last demand was dealt with, upon the advances given to other trades, and upon the condition of the trade. The matter has been fully investigated by the Industrial Court, and during the past week the award has been announced. The Court finds that the claims submitted have not been established.

The attitude taken by the employers is that the advances already made were adequate to meet the increase in cost of living since 1914; also that the position of the trade is such that any further advance in wages would be accompanied by grave risks of injury thereto.

An important part of the award reiterates an opinion expressed by the Court when the last advance was made, namely, that an alteration in the cost of living, though of great importance, does not in itself, apart from other considerations, necessarily warrant any corresponding alteration in wages. The facts of the present situation, according to evidence submitted by the employers, show that though the state of employment in the trade is still good, there are indications in some branches of the industry of a falling off in demand, and the Court is not of opinion that since the last decision was given, there has been such an improvement in the state of trade, or alteration of conditions, as to warrant a further increase in rates of wages.

No doubt there will be a great deal of discussion of the finding, and the reasons for it, in industrial engineering centres. We trust that the decision will be weighed up dispassionately and with intelligence and foresight, and that the rank and file will not allow themselves to be led by extremist sections. We have every sympathy with those who find the still rising cost of living adding to the burdens of life, but we believe that it is now becoming more generally recognised that continuous additions to the wage burdens of industry, increasing the cost of production, cannot possibly find the way out of our difficulties, while there is the danger that a slump in trade may be occasioned—indeed signs of it are not wanting in certain trades now—which will produce unemployment and distress, distress made increasingly acute because the cost of everything is so high.

The pressing need at the moment is an all-round spirit of self-sacrifice and hard work—producing more, and therefore more cheaply. The conclusion may be unwelcome, but it is inevitable. Some day the lesson may have to be learned under more serious circumstances, and we will hope for the good of the nation that the reception which this award will meet with will demonstrate a willingness to adopt a reasonable attitude, and face a lighter hardship now, in order to avoid a worse one later.

The Eight-Hour Day.

An interesting statement on this question appears in the annual report of the French Thomson-Houston Co. The law limiting the working day to eight hours came into operation in the middle of last year; it was caused by a reduction in efficiency exactly proportionate to this reduction for those working by the hour. On the other hand, the workman's effort and the improvement in methods and equipment permitted of this reduction being compensated for in a certain degree, but still insufficient in the majority of the cases of men engaged on piece work. An experience extending over nearly one year incontestably demonstrates, on the whole, that the eight-hour law has resulted, and will result, in a diminution of industrial efficiency. On this point—and at a time when the maximum production is imposed as an imperious necessity—it is stated that the law was at least premature. Supplementing this statement at the recent annual meeting, M. Charles Laurent, chairman, remarked that the transport crisis, the difficulties in obtaining raw materials, the long strike in the metallurgical and mechanical industries in June last year, and the hastily voted eight-hour day, had heavily handicapped production at the company's works; yet, possibly, the company had suffered from the consequences less than others. The improvement in the equipment and methods of working, and the extension where practicable of the system of double shifts, had rendered it possible to lessen to a certain extent the decrease in efficiency resulting from the eight-hour law.

THE MANUFACTURE OF WATER TURBINES IN ENGLAND.

The Products of Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd.

INTEREST in hydro-electric matters has received much impetus during recent years, and we are not surprised to see the most important firms taking the matter up. To those interested in electrical development, it is indeed welcome news that the vast resources which were behind the building of battleships and ordnance should now become a ready support to the development of the water turbine industry of Great Britain, and to the development of water-power schemes in the Empire and in the world in general.

The decision of the Armstrong group to take up the manufacture of water turbines, and to undertake complete hydro-electric schemes, including all civil, hydraulic and electrical work, can only be considered a very wise one. The turbines will, in the first instance, be manufactured at the Germiston Works of Messrs. Armstrongs & Main, Glasgow, who are members of the Armstrong group, but they will have the support of all the works forming this important group.

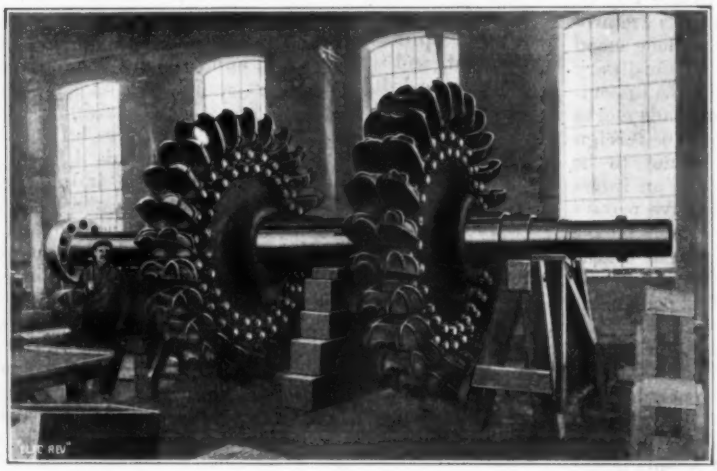

FIG. 1.—RUNNER OF 16,400-H.P. TURBINE AT RJUKAN.

The commercial side of the business will be conducted by the Hydro-Electric Section of the Civil Engineering and Contracting Department of Messrs. Sir W. G. Armstrong, Whitworth and Co., Ltd., of 8, Great George Street, London. This arrangement is certainly an advantage, as all those familiar with hydro-electric development will be aware, since every scheme will be considered round the same table as an individual entity, and not as a composition of detached sections. In this way, technical correctness will be achieved throughout, with all the advantages of economy and efficiency attendant on such an arrangement.

But the maximum output from a given water supply can only be achieved if the turbine is properly designed. The designs which Messrs. Armstrongs have decided to use, after a thorough examination of the whole question, are those of Messrs. Jensen and Dahl, of Christiania, Norway. A good idea of the kind of work which this firm has accomplished can be gathered from a mention of a few of the turbines which it has delivered in recent years.

Below we give some noteworthy examples :—

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" (No. 2 Plant) ...	16,400	250	250	1
A/S Bjolvefossen	12,000	847	375	1
Vamma Power Co. ...	12,000	26	214	1
	13,000	26	214	1
	15,000	26	214	1
Herlands Fossen Power Co.	3,500	128	600	2
Aarlifos	6,000	16·5	187·5	4
A/S Saudefaldene... ...	7,500	282	375	2
	6,700	161	750	3
A/S Traelandsfos... ...	8,000	22	214	1
A/S Skollenborg	2,750	16	250	3

From this list it will be seen that high, medium, and low-pressure turbines are well represented, but special attention may be drawn to the Pelton wheel for Bjolvefossen, working under a head of 2,780 ft., as an example of the high heads with which this firm is able to deal.

Fig. 1 shows the runners for the 16,400-H.P. set installed in the world-famed plant known as Rjukan 2. Fig. 2 shows the complete turbine.

Fig. 3 shows the 12,000-H.P. turbine for the Bjolvefossen Co., Ltd., completed in the erection shop.

Fig. 4 illustrates an excellent example of a low-pressure double Francis turbine in steel-plate casing, with an output of 13,000 H.P., as installed in the power plant at Vamma, Norway, which, when completed, will be one of the largest and most compact power plants in the world. A 16,000-H.P. set is now being constructed by Messrs. Jensen & Dahl for the same company. The efficiency obtained on the 13,000-H.P. unit for this plant can be seen from fig. 5, and the favourable comparison between this and the guaranteed efficiency should be noted.

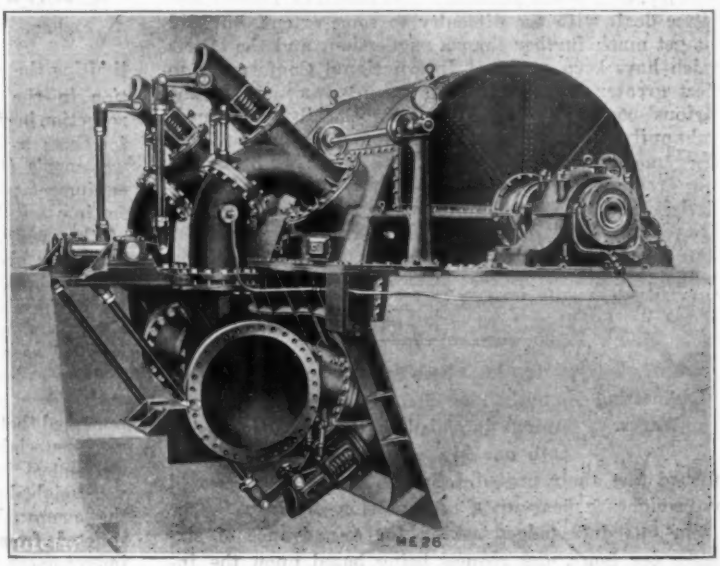

FIG. 2.—COMPLETE TURBINE, 16,400 H.P.

The main points in the design of turbines fall under two heads, namely, (*a*) Hydraulic, (*b*) Mechanical.

It is difficult to see exactly how far the points coming

under the heading (*a*) are the result of the study of theory, and how far of practice. More frequently than not,

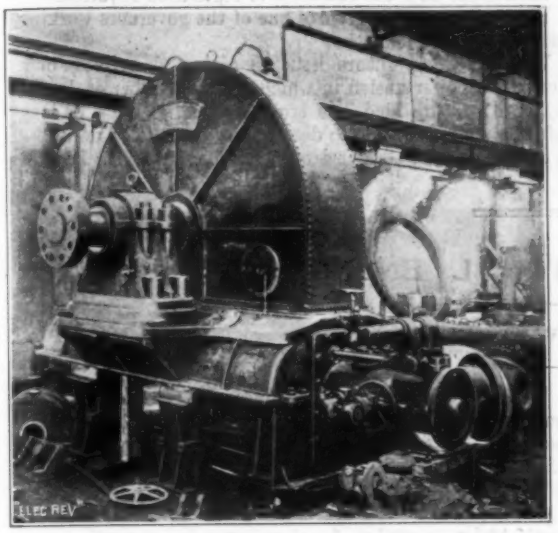

Fig. 3.—Turbine for Bjolvefossen Co., 12,000 h.p.

alterations in hydraulic design are an outcome of the combination of both, and as the Christiania firm has been building water turbines since 1849, it is clear that its accumulated experience must be of immense value, as, indeed, has been proved by the work it has turned out.

It will not be out of place to mention a few of the noteworthy points in the design of Francis turbines, Pelton wheels and governors.

Messrs. Jensen & Dahl were, so far as we can trace, the first firm of water turbine builders to adopt "outside regulation" as a general practice. The necessity for this was obvious from the fact that the highest possible efficiency could only be obtained provided the flow of water through the guide vanes to the wheels was absolutely smooth and uninterrupted. A further advantage which outside regulation ensures lies in the fact that all moving parts

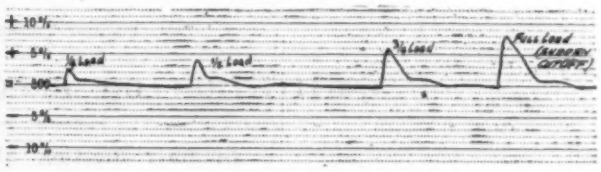

Fig. 6.—Speed Regulation Curve.

liable to rust are separated from contact with the water. Instead of the guide vanes being bronze-bushed and moving on separate pins, the pin and vane in the Jensen turbine are solid cast and the pins are journalled in brass, and all necessary lubrication can be done from the outside. The buckets are of steel plate cast into the hub and band.

Another important point is that the bearings are in all cases entirely separated from the water passages and can be readily inspected.

As is well known, the main mechanical trouble with Pelton wheels is the liability of the buckets to become loose—and even to seek "fresh woods and pastures new" through the power-house walls and roof. In the Jensen Pelton wheel this is rendered impossible, as by a method of keeping the buckets together, they are made to form a continuous ring, and cannot become detached.

The turbine governors are of the "automatic oil-pressure" type.

So much depends on the turbine governor that it is perhaps well to describe some of the special features of the "Jensen Armstrong" governor.

1. The regulating valve is so constructed that the governor only works with an oil pressure corresponding to the actual water pressure acting on the turbine gates. The safety valve remains closed under normal operation.

2. The regulating valve is directly connected with the governor proper, or pendulum, and rotates with it. In this way it will hardly be possible for foreign matter in the oil (even of large size, as, for instance, cotton waste, &c.) to impede the action of the valve and cause trouble.

3. The governor pendulum is, practically speaking, free from friction. Its design is of remarkable simplicity, and it works without any tap or bolts whatever; the centrifugal weights simply move over thin elastic sheet-steel strips.

4. There is no pressure-tank requiring constant attention.

5. All rotating parts are amply lubricated automatically. Wear and tear is thereby reduced to a minimum.

6. When the loose cover over the governor case is removed, practically all parts of the governor are open for inspection.

7. The governor is so arranged that pump and regulating

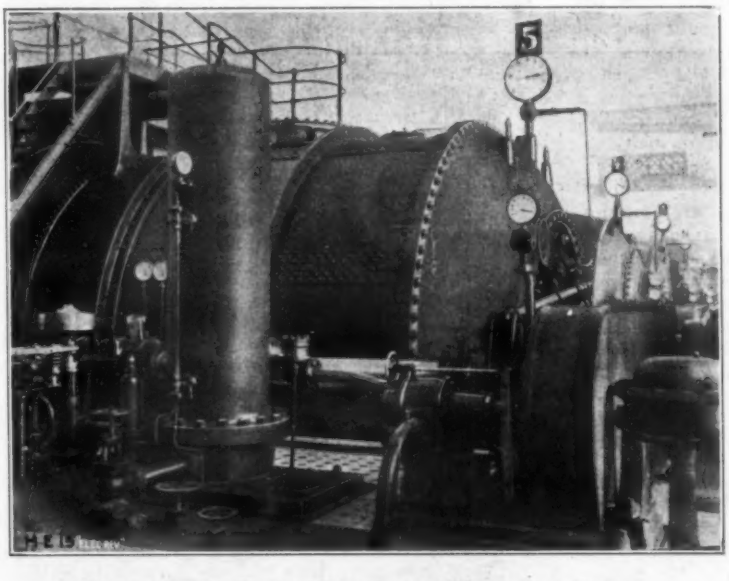

Fig. 4.—Double Francis Turbine of 13,000 h.p., at Vamma.

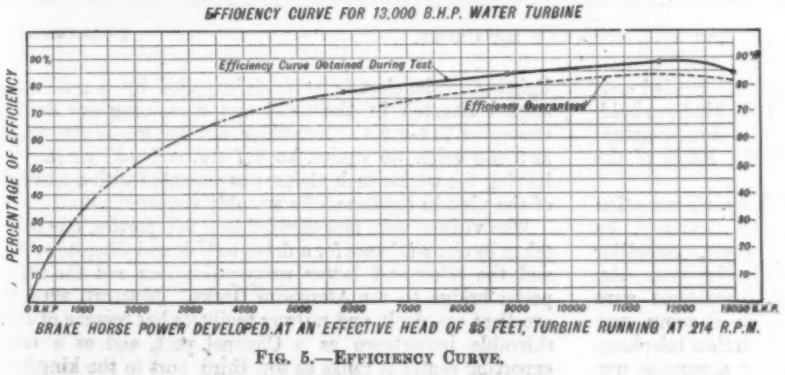
EFFICIENCY CURVE FOR 13,000 B.H.P. WATER TURBINE
Efficiency Curve Obtained During Test
Efficiency Guaranteed
PERCENTAGE OF EFFICIENCY
B.H.P.
BRAKE HORSE POWER DEVELOPED AT AN EFFECTIVE HEAD OF 85 FEET, TURBINE RUNNING AT 214 R.P.M.

Fig. 5.—Efficiency Curve.

valve can be mounted on either side of the governor case, and so be arranged to change places with each other.

The closing direction of the governor can be changed by merely turning the governor 180°, because the base is symmetric with reference to a plane through the regulating shaft. This is a great advantage, because in the course of time it sometimes becomes necessary to alter the governor arrangement, or to utilise it for another turbine.

The opening—or closing—time of the governor, on which the maximum speed fluctuations of the turbine depend, can be adjusted as desired to suit existing conditions, with reference to fly-wheel momentum and length of penstock, and in accordance with the exactness of regulation required.

Fig. 6 shows a tachogram of one of the governors working under everyday conditions.

We hope in a future issue to give a description of a Norwegian power station in which a large number of Jensen turbines are installed, and trust that it will not be long before we may be able to describe sets actually delivered by Messrs. Sir W. G. Armstrong, Whitworth & Co., Ltd.

INSTITUTION OF ELECTRICAL ENGINEERS.

Summer Meeting at Western Centre.

On Tuesday afternoon, July 13th, a party of members and friends of the Institution of Electrical Engineers assembled at Cardiff to take part in the summer meeting of the Institution at the Western Centre. The programme consisted of a three days' tour of South Wales and Monmouthshire, in the course of which, in addition to civic receptions and other social functions, visits were paid to works, docks, and places of interest in the neighbourhood; it was particularly requested that "shop" should be avoided as much as possible, and consequently no papers were read, neither did any discussions take place.

Fine weather was enjoyed throughout the whole of the tour, which was admirably organised, and the various reception committees are to be congratulated upon the manner in which the different functions were carried out. The meeting was voted one of the best of its kind yet held, and a high standard was set for meetings of a similar nature to be held in the future; the presence of the ladies of the party was particularly appreciated.

The official proceedings commenced with a civic reception at the City Hall, Cardiff, on the Tuesday evening, by invitation of the Right Hon. the Lord Mayor, Councillor G. F. Forsdike, J.P., O.B.E., and the Lady Mayoress. An excellent vocal concert and a musical programme were enjoyed, following which guests joined in dancing, and during the evening two demonstrations of wireless telephony were given by Mr. Barfield. The receiving apparatus was set up in the City Hall, the transmitting station being the Marconi station at Chelmsford; this was believed to be the first occasion on which wireless telephonic reception had taken place in the city of Cardiff.

The following morning, Wednesday, the visitors were conveyed by chars-à-bancs to Newport, where the works of the British Mannesman Tube Co. were inspected, and the different processes in the manufacture of steel pipes were watched with much interest. The company has secured large contracts for oil and water pipe lines in Japan and South Africa, as well as for the piping in connection with the oil wells that are being bored in this country.

In the works it was noted that electric welding was employed for building up and joining component parts, while for cutting purposes the oxy-acetylene flame was used. The large rolls are rope-driven by means of horizontal gas engines, but a considerable quantity of electricity is used besides to drive cranes, machine tools, &c., in addition to lighting. The electric power is supplied by a generating station situated in the works and containing two Bellis-Crompton 714-K.V.A. three-phase alternator sets generating at 3,000 volts, 50 cycles, at 0·7 P.F. and 333 R.P.M. On leaving the works, each visitor was presented with a souvenir of the visit in the form of a suitably engraved cup.

Photo by] THE I.E.E. AT CAERPHILLY CASTLE. *[Welsh Pictorial Co.*

The visitors were now divided into two parties, one being taken by chars-à-bancs for a drive to Usk and Chepstow, &c., and the other and larger party proceeding *viâ* the transporter bridge to the Alexandra Docks. Newport, with its excellent sea, dock, and railway facilities has become of considerable importance as a Channel port, and as a coal-exporting centre it ranks as the third port in the kingdom, the annual shipments amounting to six million tons. It is not our purpose to enter into a lengthy description of the docks and their up-to-date hydraulic equipment, but a few words about the new sea entrance lock may be interesting.

This lock is 1,000 ft. long × 100 ft. wide, being the largest deep-sea entrance lock in the world. The depth of water on the outer sill of the lock at high-water spring tides is 45 ft., and at neap tides 35 ft. For all practical purposes the north and south docks, with their connecting junction, may be looked upon as one dock, with a total deep-water area of 125 acres. The power station, which was built in connection with the new lock, contains two fine pumping units. The engines, by Messrs. Cole, Marchent & Morley, Ltd., Bradford, are of the triple-expansion, vertical, three-crank, surface-condensing type, designed to run at from 80 to 125 R.P.M., at which they develop 800 and 1,600 H.P. respectively; they are coupled direct to centrifugal pumps by Messrs. Boving & Co., Ltd., London, which in practice deliver 6,000,000 gallons per hour, against a maximum head of 36 ft. The electrical generating plant consists of two Howden-B.T.H. sets; triple-expansion steam engines direct coupled to 500-KW. three-phase alternators, star wound, 3,633 volts between phases, 50 cycles, 300 R.P.M. The hydraulic pumping plant, which supplements the power supplied from the main hydraulic station, was built by Messrs. Galloways, Ltd., Manchester, and comprises a triple-expansion horizontal surface-condensing engine capable of delivering 1,250 gallons of water per minute against a pressure of 830 lb. per sq. in. when running at 40 R.P.M. Steam for the whole of the plant is supplied from a range of six Lancashire boilers, with a working pressure of 180 lb., and a superheat temperature of 530° F. The boilers are mechanically stoked, and the coal-handling plant is electrically driven.

A cruise round the docks on board a tug terminated the visit; members then assembled at the Town Hall, where they were received by his Worship the Mayor, Councillor Peter Wright, J.P., and afterwards partook of luncheon by invitation of the Mayor and the Electricity Committee of the County Borough of Newport. During the luncheon, Mr. J. A. Gaccon, F.R.C.O., borough organist, presided at the organ, and Mr. D. H. Thomas's songs were much appreciated.

In the afternoon the party was driven *viâ* Bassaleg, Machen, Rudry, to Caerphilly Castle ruins, where a photograph, a copy of which is reproduced herewith, was taken. The Castle, which belongs to the Marquis of Bute, is supposed to have been built between 1268 and 1271 by Gilbert de Clare, the Red Earl, to guard the pass of Senghenydd, and to keep out the Welsh from the Lowlands, and is a splendid example of the finest fortresses of the middle ages. It was besieged during the Civil War, after which the leaning tower, which is 9 ft. out of plumb, was tilted in an attempt to blow it up with gunpowder. The only part of the building which now has a roof is the old banqueting hall, in which tea was provided by the South Wales Electrical Power Distribution Co.

On the journey back to Cardiff, the chars-à-bancs passed under one of the longest spans of the overhead power line erected by the South Wales E.P.D. Co. The span, as explained by Mr. W. A. Chamen, is ¾-mile long, stretching between two hills, and carries 2,000 KW. at 11,000 volts. The three stranded copper conductors are of 0·1 sq. in. section, and are placed one above the other with about 5 ft. clearance between each, the fourth and bottom conductor being the earth wire. Wood poles are used, constructed on Mr. Kaye's principle, and no trouble whatever has been experienced with the line. Two other long spans are a quarter and half a mile in length; at certain times the conductors have been observed to stand 20 ft. out of the vertical owing to wind pressure. They do not oscillate, however, and there is no record of a single insulator failure, although at other parts of the line a certain number of insulators are broken by stone throwing.

In the evening a reception was held at the City Hall, Cardiff, by Mr. R. T. Smith, president of the Institution of Electrical Engineers, assisted by Mr. J. Dyer Lewis, president of the South Wales Institute of Engineers, and Sir John Beynon, Bart., C.B.E., chairman of the Monmouthshire and South Wales Coalowners' Association, which was followed by a dinner given by the latter Association, at which some 200 covers were laid; at other functions the number of guests averaged about 130.

On Thursday, the second day of the tour, the visitors proceeded to Bristol by train, *viâ* the Severn Tunnel, and on arrival at the Council House a civic reception was held by the Right Hon. the Lord Mayor, Councillor G. T. Francombe, and the Sheriff, Mr. W. A. Titley. The party then crossed the street to the Grand Hotel, where luncheon was served, the host being Alderman George Pearson, the popular chairman of the Bristol Electricity Committee.

The afternoon was taken up by the most picturesque and enjoyable drive of the whole tour, the route being by way of Clifton Downs and across the suspension bridge spanning the beautiful Avon gorge and onwards through shady woods. The climb up over the Mendip Hills, passing *en route* the old Roman road and lead mines, followed by the descent into the majestic Cheddar gorge, was safely negotiated. To adequately describe these beautiful cliffs, which have been termed the finest inland cliffs in Europe, is beyond our power, but the visitor cannot do other than take away vivid mental photographs of cliff scenery so memorable.

Tea was taken at Cheddar, after a visit had been paid to Gough's caverns, where excellent specimens of stalactite and stalagmite formations were seen in profusion and electrically illuminated. Continuation of the drive brought the party to Weston-super-Mare, the arrival being well timed to coincide with high tide. An excellent dinner was disposed of just in time to allow the visitors to board the steamer which conveyed them back across the channel to Cardiff.

On Friday, the last day of the tour, members proceeded to Swansea by train, and after viewing the docks with their up-to-date facilities for coal shipment, the Scherzer rolling lift bridge which only needs a 10-H.P. motor to open it, and the ship-breaking yard in which were seen two or three war ships together with some 30 German submarines, drove round the bay to Mumbles pier, where his Worship the Mayor of Swansea, Alderman A. Sinclair, J.P., M.I.E.E., entertained them at luncheon. During the afternoon the party assembled in chars-à-ban s for a drive to Langland and Caswell Bays. After a light tea, some of the visitors who had elected to remain over the week-end went for an extended drive into the Gower Peninsula, while the majority returned to Swansea in time to board the evening train for London and the North. Thus concluded one of the most successful tours ever planned by the Institution.

During the meeting, members were allowed free transport on the Cardiff City tramcars, and, by the courtesy of Captain S. B. Haslam, arrangements were made for visitors to play golf at several clubs. Altogether the meeting was highly successful in every way, and in concluding this brief account of the tour, the members of the Executive Reception Committees, and in particular Mr. C. T. Allan, are to be congratulated on the excellence of the arrangements made, and the manner in which they were carried out.

Floating Dock and Crane.—The new 150-ton electrically operated floating crane, which has been supplied by Messrs. Cowans, Sheldon & Co. to the Cockatoo Island Dockyard, Sydney, is of the same power and type as those which have been already supplied to the British Admiralty. The design is peculiarly British in character, presenting marked differences from the large floating cranes which have been built by Continental firms. In their practice the revolving weight is poised on the centre tower, but Messrs. Cowan, Sheldon & Co. have given preference to a patented method of their own, whereby the dead load is carried by a large roller pall on the deck of the pontoon, and the tower is utilised only to carry the unbalanced force. This method not only saves material—an important consideration at to-day's prices—but by reducing the stresses bring wear and tear down to a low figure. In addition to lifting 150 tons at 90 ft. radius and 100 tons at 125 ft., the crane is fitted with derricking and revolving gears, as well as a transporter trolley. Power for operating the crane is supplied either from an independent source ashore, or by a steam-driven dynamo housed in the pontoon. The electrical control apparatus is of the contactor type, which presents the advantage that the motors can be run at the same relative speed under all conditions of loading. The control apparatus and switchgear are installed in the operator's cabin. The steam generators were supplied by the British Westinghouse Co., and the motors and control gear by the British Thomson-Houston and Siemens Co.'s.—*Journal of Commerce.*

THE ELECTRIC HOUSE.

In June last year, drawing attention to the immense possibilities for the development of the applications of electricity to domestic purposes which had been opened by the new conditions obtaining in respect of domestic service, &c., we expressed the opinion that an exhibition should be held in London devoted wholly to the demonstration of electrical cooking and heating apparatus, "together with any other electrical labour and fuel-saving devices that can be brought together." We described and illustrated a variety of such appliances which had been developed in America, where the need for them had existed for many years, and in a later issue (July 11th, 1919) we returned to the subject, and mentioned that an exhibition on the lines we advocated—"an 'Electric Home,' devoted entirely to the purpose of illustrating the limitless possibilities of electricity in the household"—was already in preparation.

Fig. 1.—Georgian Entrance Hall, and Chinese Lacquer Room of the Queen Anne Period.

It is interesting to record that the house is the realisation of a fairy story written by one of Mr. Berry's children (Miss Nancy Berry)—"Mr. Touchbutton, or the Home of Beautiful Ideals," published by Messrs. Country Life, Ltd., —which we briefly reviewed some months ago. As a matter of fact, the story largely consisted of a description of the electric labour-saving devices which surrounded the young author in her own home. Mr. Berry had previously contemplated the arrangement of a permanent exhibition to bring home to the public the amenities of electrical methods in the household with his famous "Magicoal" fire as the nucleus, and every conceivable labour-saving device, no matter what its origin, as an additional feature. Thus came into existence "Touchbutton House," the very thing that, unaware of Mr. Berry's plans, we called for.

The House is built around a definite theme—the origin and development of the domestic fire.

A special point is given to this by the recent issue of the interim report of the Committee on Smoke and Noxious Vapours Abatement, which directs attention to the fact that even in industrial areas domestic chimneys contribute at least 50 per cent. of the total smoke nuisance, and that 2½ million tons of soot are discharged into the atmosphere by them every year. The cost to the community for cleansing and for repairing damage to buildings, as well as the injury to health, is enormous, while the necessity of constructing fireplaces and chimneys adds some £30 to the cost of a small house. "Central heating" is recommended, and is being installed in a colony of 2,000 houses at Manchester, costing the residents from 6d. to 1s. a week; and the adoption of central heating in individual houses generally is strongly advised. The Committee considers that not more than one, or at most two, coal grates should be permitted in any of the houses built with the assistance of the Government subsidy, and that smokeless methods of supplying heat should be made essential features of building schemes.

At Touchbutton House the evolution of the coal fire is happily illustrated, from the primitive Norman hearth to he present day, either with actual antique grates of the various periods or with exact facsimiles of them, in which Mr. Berry's "Magicoal" fires glow merrily, radiating a pleasant feeling of comfort without the accompaniment of heat. The grates are mounted in appropriate surroundings, the fire-places and mantelpieces being original antiques or

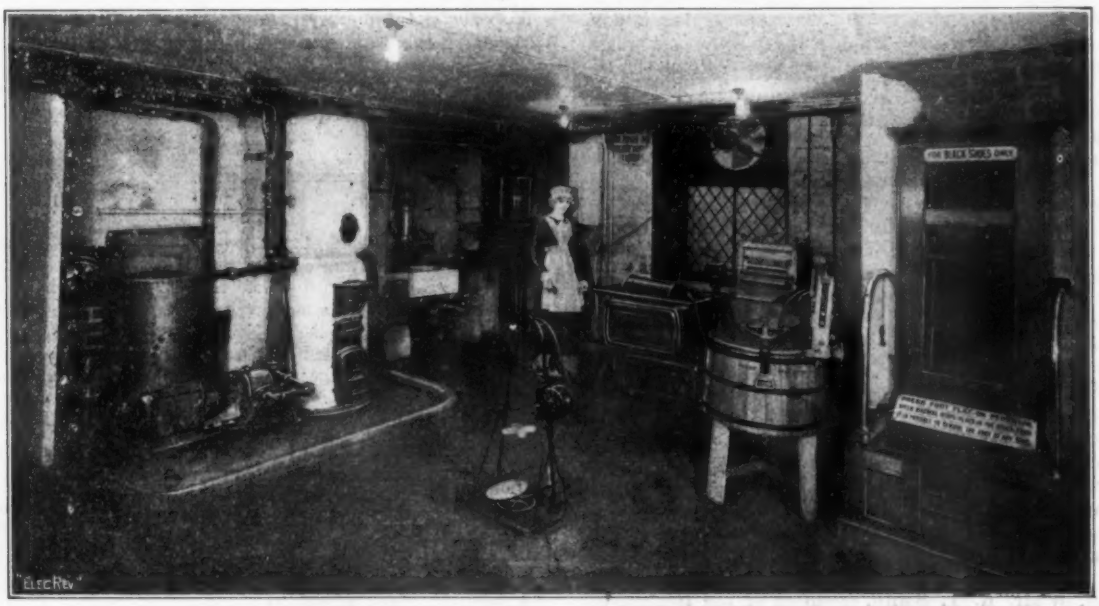

Fig. 2.—Touchbutton House: Heating and Washing Appliances, &c., in Scullery.

It has taken many months longer than was then anticipated to complete the arrangements, but on Friday last we had the pleasure of inspecting the all-electric house—"Touchbutton House," 86, Newman Street, Oxford Street, London, W.—where Mr. Herbert H. Berry, of Berry's

replicas, as shown in our illustrations. In parenthesis, we should point out that the antiquarian interest of the collection of beautiful furniture, including many specimens of very great value, of panels, ceilings, and tapestry, of pictures, and various other items, is in itself ample inducement for a visit to the house. We cannot attempt to describe these treasures—they can be seen at any time, and we cordially recommend our readers to avail themselves of the first opportunity of inspecting them in person. We must pass on to explain the plan underlying Mr. Berry's scheme.

In brief, his policy is to use the best available device—in respect of economy of fuel or saving of labour—for each purpose. With this principle in view, he advocates the use of a highly efficient anthracite stove for heating water, both for general heating and for domestic purposes, the same apparatus (which is prominently visible in fig. 2) supplying low-temperature water for the convectors, and water at a temperature of 150° F. for cooking, &c. Either electricity or gas can be used for "topping-up"—*i.e.*, bringing water to the boil, &c.—for while Mr. Berry's leanings are naturally towards the former, he recognises

Fig. 3.—Elizabethan Hall, with Queen Anne Panelled Room beyond.

that in some localities and under some circumstances, the latter may happen to offer advantages. That is the gist of the scheme; upon that framework everything else depends. We can do little more than give a list of some of the more notable features of the equipment, which are: a Permutit water softener; an electric geyser over the sink; two or three electric washing machines; an ironing machine (heated by gas); an electric boot-cleaner; the Hobart electric "kitchen-aid" (described in our issues of July 11th and 18th, 1919); electric cookers, large and small (250 of the latter size are being installed in artisans' dwellings on Tyneside, on a price basis), an anthracite cooking range which also heats water, a miniature Niagara of hot water which washes and dries dishes without their being touched by hand, a cabinet sewing-machine, a self-contained electric lighting set, an electric piano, the Dictaphone, a great variety of beautiful bowl fittings for semi-indirect lighting, small table appliances for cooking and toasting, &c., &c., for we cannot name all the delightful devices here brought together. We may mention that the ancient mantelpieces include Elizabethan, Queen Anne, Georgian and other examples, from Plas Mawr, Tattershall Castle, Woodsome Hall, &c.; the collection is valued at about £100,000, and some of the pieces are so rare that they are not represented in the South Kensington Museum.

Everywhere is the Magicoal fire, which at a touch of a button blazes forth instantaneously; further buttons switch on radiators which, on the principle of "topping-up," add any desired degree of heating to the steady temperature maintained by the central heating system.

By the use of the methods here briefly outlined, Mr. Berry claims to save one-half of the cost and one-half of the labour in running a house. When it is suggested that servants do not know how to use the devices placed in their hands, he replies that with the aid of a portable kinematograph (the Oxford projector), he will show them the way, and he will, in fact, provide a class of instruction for domestics—and their mistresses—at Touchbutton House.

With the aid of thermostats, the temperature of the house can be kept constant within a few degrees of 55° F., which is quickly brought up to 60° or 65° when desired. The apparently blazing fire costs less to "burn" than a wax candle, and the whole of the 44 rooms in Touchbutton House are warmed and supplied with hot water by the one small furnace illustrated in fig. 2.

Amongst other interesting items, we should not omit to mention an apparatus for high-frequency treatment (with which Mr. Berry has effected some marvellous cures). He also proposes, in order to deal with a rush of visitors, to devise a system of automatic salesmanship, according to which a visitor will sit in a chair while a Dictaphone tells him or her all about the contents of the room, and finally invites him to pass into the next room and sit down on a similar talking chair!

Crowded as Touchbutton House is with rare antiquities, the atmosphere there breathes the very spirit of progress and invention, and the presiding genius, surrounded by a staff of experts in art and engineering, diffuses a sensation like that of a fresh breeze on a hot day. Go and see Mr. Touchbutton!

THE NATIONAL PHYSICAL LABORATORY.

The report on the Laboratory for the year 1919 has been issued; it contains some particulars of special work done during the war period which it was previously necessary to treat as confidential. The past year was marked by the further development of the method of working the Laboratory, under the financial control of the Treasury, as a branch of the Department of Scientific and Industrial Research. Reference is made in the report to the new buildings and extensions that have been completed, and to others that will be needed in the near future; H.M. Office of Works is now responsible for the maintenance of buildings, plant, and services as distinct from equipment. Staff salaries and conditions of service have been revised, and in many respects brought into line with those holding generally in the Civil Service. Important changes in staff are recorded; the number employed in testing gauges has been reduced by 60 per cent., and the staff employed for special purposes disbanded. On the other hand, there has been a large increase in the staff engaged in testing clinical thermometers.

A comparison of the number of tests made in the years 1918 and 1919 are respectively as follows: In the physics department, 182,617 and 1,261,693; in the electricity department, electrical measurements numbered 272 and 701; electrotechnical apparatus 7,408 and 6,628; photometry 24,673 and 12,986; in the metrology department 26,579 and 27,805; engineering department 316 and 763; and in the William Froude tank 41 and 58 tests were made.

With regard to commercial testing, proposals for State action in respect of the promotion of standardisation, in which the N.P.L. would take a part, are now under consideration. The Board of Trade Electrical Standards Laboratory was transferred to the N.P.L. in May last, the Laboratory undertaking the custody and maintenance of the standards on behalf of the Board of Trade, and will carry out for the public such comparisons as may be required; approval of the pattern and construction of electricity supply meters, and other instruments submitted will be given by the Board on the Laboratory's report.

Brief reference may now be made to some of the more important researches.

The heat division of the physics department has been much occupied recently with investigations relating to refrigeration problems. Considerable attention has also been directed to the heat losses in furnaces employed in industrial processes, and the thermal properties of materials used.

In the thermometry division the extension of the clinical thermometer testing has been the chief feature. This division is also responsible for the testing of oils for flashpoint and viscosity, and the investigational work in this connection in progress before the war has again been actively resumed.

In the early part of the year a considerable number of telescopes and gun-sights, binoculars, &c., were submitted for test in the optics division, under Admiralty contracts. These tests have since greatly diminished in volume. A new spectrometer for measurements of high accuracy has been designed and is now under construction.

In the radium and X-ray division a new method for the measurement of the radium content of radium samples has

been used with success. Equipment has been provided for the investigation of protective materials for use in X-ray work. The examination by means of X-rays of the material of the pots prepared in the metallurgy department for use in the production of optical glass has given useful results.

The tide-prediction division has been asked to make predictions for a number of New Zealand ports.

During the war Mr. F. E. Smith, Mr. Campbell, Mr. Paterson, and other members of the staff in the electricity department have been very much occupied with special war problems. Some account is now given of a number of these investigations. They include the development of wireless directional apparatus, in which valuable assistance was given by the late Mr. Duddell, and which, early in the war, was carried to a high degree of efficiency at the Laboratory, the perfection of amplifying valves for various special purposes, improvements in compass magnets, and the investigation of sound-receiving and sound-ranging apparatus. Mr. Paterson and Mr. Walsh spent much time during the war in the development of height-finding apparatus with electrical transmission gear for use in anti-aircraft work and in supervising the installation of such apparatus in this country and in France. During the war Dr. Rayner was attached for three years to the Inventions Department of the Ministry of Munitions as adviser on the practicability of suggestions sent in, and to assist in the design and construction of apparatus approved for trial. Mr. Smith's recent researches, carried out for the Ordnance Committee, on the velocities of projectiles and gun recoil have led to results of great interest. Since the armistice work on the fundamental electrical standards has been resumed; this will need much attention during the coming year. The research on buried cables, which is under the charge of Mr. Melsom, has made good progress, and valuable work has been done in the investigation of resistance materials.

The metrology department has during the year been concerned mainly with the gradual transition from war to peace conditions. A certain amount of private gauge work has been received, and it is hoped that the experience of the war has convinced commercial firms of the high importance and economic value of such tests. A considerable amount of work has been done in an advisory capacity, in connection with the design of gauges for standard specifications issued by the British Engineering Standards Association. In addition to the gauge work, the department has been very much occupied in the latter part of the year with the restoration of values of various standards which have been left unexamined during nearly five years of war.

The report of the engineering department gives an account of a large number of interesting and valuable researches which have been completed or are still in progress.

An investigation has been carried out on the lubricating efficiency of a series of animal, vegetable, and mineral oils, and has furnished results of importance. In connection with this work apparatus was designed and constructed in the department for the determination of the viscosity of oils at high pressures. The problem was one of considerable difficulty and the method employed presents novel and interesting features. The interesting experiments on the transmission of heat from surfaces to fluids flowing over them have been continued; the work has included the examination of the effect of surface roughness. The experiments are of importance in connection with the cooling of engines. Methods of measuring the skin friction between flat surfaces and fluids passing over them have been investigated. The researches into methods of notched bar impact testing, and of hardness testing, have been continued. Tests of gas cylinders, fatigue tests of wire and camel hair ropes, and an investigation of the tooling characteristics and brittleness of electrical insulating materials may also be mentioned.

An extensive programme of aeronautics research has been carried out under the control of the Advisory Committee for Aeronautics. Many improvements in detail have been introduced in the methods of test employed.

The account given in the report of the metallurgy department of the investigations carried out in relation to the war contains much interesting material. The most important work done was in connection with the production of light alloys, especially for aircraft and aero-engines. Alloys were developed to meet special requirements for castings in general, and for parts, *e.g.*, pistons, working at high temperatures; wrought alloys were produced for use in the construction of rigid airships, aeroplane spars, &c.; and the rolling of light alloys into thin sheets to serve as a substitute for fabric in covering aeroplane wings was successfully accomplished. A considerable number of special investigations were carried out with a view to the provision of suitable alloys as substitutes for other alloys used in the production of various munitions of war when difficulties arose as to the supply. Investigations were carried out on steel for torpedo air vessels and turbine gearing, and the causes of failure were successfully investigated. Methods of hardening and casehardening of war material were examined and improved. A large amount of analytical work has also been carried out, including the analysis of various materials used by the enemy.

The researches relating to the production of optical glass have made good progress.

Further particulars of work of electrical interest carried out during the year will be given in our next issue.

(To be concluded.)

ELECTRICITY SUPPLY DISTRICTS.

NOTICE is given that the Electricity Commissioners have provisionally determined that the undermentioned areas shall be constituted separate electricity districts for the purposes of the Electricity (Supply) Act, 1919:—

LONDON AND HOME COUNTIES.

The City of London.

The County of London, *i.e.*, the Metropolitan Boroughs of Battersea, Bermondsey, Bethnal Green, Camberwell, Chelsea, Deptford, Finsbury, Fulham, Greenwich, Hackney, Hammersmith, Hampstead, Holborn, Islington, Kensington, Lambeth, Lewisham, Paddington, Poplar, St. Marylebone, St. Pancras, Shoreditch, Southwark, Stepney, Stoke Newington, Wandsworth, Westminster, and Woolwich.

The County of Middlesex.

So much of the County of Berks as is included in: The Municipal Borough of New Windsor; the Rural District of Windsor.

So much of the County of Buckingham as is included in: The Urban Districts of Beaconsfield, Eton, and Slough; the Rural District of Eton; the parishes of Chalfont St. Giles, Chalfont St. Peter, Chenies, and Seer Green Chapelry in the Rural District of Amersham.

So much of the County of Essex as is included in: The County Boroughs of East Ham and West Ham; the Urban Districts of Barking Town, Brentwood, Buckhurst Hill, Chingford, Epping, Grays Thurrock, Ilford, Leyton, Loughton, Romford, Tilbury, Waltham Holy Cross, Walthamstow, Wanstead, and Woodford; The Rural Districts of Orsett and Romford; the parishes of Childerditch, Little Warley, South Weald, and West Horndon in the Rural District of Billericay; the parishes of Chigwell, Epping Upland, Theydon Bois, and Theydon Garnon in the Rural District of Epping; the parishes of Lambourne, Navestock, Stamford Rivers, Stapleford Abbotts, Stapleford Tawney, and Theydon Mount, in the Rural District of Ongar.

So much of the County of Hertford as is included in: The Municipal Boroughs of Hertford and St. Albans; the Urban Districts of Barnet, Bushey, Cheshunt, Chorleywood, East Barnet Valley, Harpenden, Hoddesdon, Rickmansworth, Ware, and Watford; the Rural Districts of Barnet, Hatfield, Hertford, St. Albans, Ware, Watford, and Welwyn.

So much of the County of Kent as is included in: The Municipal Boroughs of Hertford and St. Albans; the Urban Districts of Beckenham, Bexley, Chislehurst, Dartford, Erith, Footscray, Northfleet, Penge, and Sevenoaks; the Rural Districts of Bromley and Dartford; the parishes of Brasted (excluding the detached portion), Chevening, Dunton Green, Halstead, Kemsing, Otford, Riverhead, Seal, Sevenoaks Weald, Shoreham, Sundridge, and Westerham, in the Rural District of Sevenoaks.

So much of the County of Surrey as is included in: The County Borough of Croydon; the Municipal Boroughs of Guildford, Kingston-upon-Thames, Reigate, Richmond, and Wimbledon; the Urban Districts of Barnes, Beddington and Wallington, Carshalton, Caterham, Chertsey, Coulsdon and Purley, Dorking, East and West Molesey, Egham, Epsom, Esher and the Dittons, Ham, Leatherhead, Merton and Morden, Mitcham, Surbiton, Sutton, The Maldons and Coombe, Walton-upon-Thames, Weybridge, and Woking; the Rural District of Epsom; the parishes of Bisley, Byfleet, Pyrford, and Thorpe, in the Rural District of Chertsey; the parishes of Dorking Rural, Effingham, and Mickleham, in the Rural District of Dorking; the parishes of Addington, Bletchingly, Chelsham, Crowhurst, Farleigh, Godstone (except the detached portion), Limpsfield, Oxted, Tandridge (except so much of the said parish as lies to the south of an imaginary straight line drawn from the point where the western boundary of the said parish joins the southern boundary of the parish of Godstone to the point where the eastern boundary of the said parish joins the southern boundary of the parish of Crowhurst), Tatsfield, Titsey, Warlingham, and Woldingham, in the Rural District of Godstone; the parishes of East Clandon, East Horsley, Merrow, Ockham, Pirbright, Send and Ripley, West Clandon, West Horsley, Wisley, and Worplesdon, in the Rural District of Guildford; and the parishes of Betchworth, Buckland, Chaldon, Chipstead, Gatton, Kingswood, Liberty, Merstham, Nutfield, and Walton-on-the-Hill, in the Rural District of Reigate.

MERSEY AND WEST LANCASHIRE.

In the County of Lancaster: The City and County Borough of Liverpool; the County Boroughs of Bootle, Southport, St. Helens, and Warrington; the Municipal Borough of Widnes; the Urban Districts of Formby, Great Crosby, Huyton-with-Roby, Lathom and Burscough, Litherland, Little Crosby, Newton-in-Makerfield, Ormskirk, Prescot, Rainford, Skelmersdale, and Waterloo-with-Seaforth; the Rural Districts of Sefton, West Lancashire, and Whiston, and the parishes or townships of Burtonwood, Cuerdley, Great Sankey, Houghton, Middleton and Arbury, Penketh, Poulton-with-Fearnhead, Southworth and Croft, Winwick-with-Hulme, and Woolston-with-Martincroft, in the Rural District of Warrington.

In the County of Chester: The County Boroughs of Birkenhead and Wallasey; the Urban Districts of Broomborough, Ellesmere Port and Whitby, Higher Bebington, Hoylake and West Kirby, Lower Bebington, Neston and Parkgate, and

Runcorn; the Rural Districts of Runcorn and Wirral, and the parishes or townships of Bridge Trafford, Dunham-on-the-Hill, Elton, Hapsford, Ince, Little Stanney, Stoke, Thornton-le-Moors, and Wimbolds Trafford, in the Rural District of Chester.

NORTH WALES AND CHESTER.

The Counties of Anglesea, Carnarvon, Denbigh, Flint, Merioneth, and Montgomery.

So much of the County of Cardigan as is included in: The Municipal Borough of Aberystwith; the Rural District of Aberystwith; and the township of Scybor y Coed.

So much of the County of Chester as is included in: The City and County Borough of Chester; the Municipal Borough of Crewe; the Urban Districts of Hoole, Middlewich, Nantwich, Northwich, Tarporley, and Winsford; the Rural Districts of Malpas, Nantwich, Northwich, and Tarvin, and the parishes or townships of Bache, Backford, Blacon-with-Crabhall, Capenhurst, Caughall, Chester Castle, Chorlton-by-Backford, Christleton, Claverton, Croughton, Doddleston, Eaton, Eccleston, Great Boughton, Great Saughall, Hoole Village, Lea, Little Saughall, Littleton, Lower Kinnerton, Marlston-with-Leach, Mickle Trafford, Mollington, Moston, Newton-by-Chester, Pickton, Poulton, Pulford, Shotwick, Shotwick Park, Upton, Wervin, and Woodbank, in the Rural District of Chester; and

So much of the County of Salop as is included in: The Municipal Borough of Oswestry; the Urban Districts of Ellesmere, Wem, and Whitchurch; the Rural Districts of Ellesmere, Oswestry, Wem, and Whitchurch.

LOCAL INQUIRIES.

Notice is further given that the Electricity Commissioners intend to hold local inquiries into the existing organisations for the supply of electricity in the districts so provisionally determined. Notice will be given of the dates of the proposed inquiries. Schemes for effecting improvements in existing organisations, including the formation of Joint Electricity Authorities for the districts, and any proposals for altering or adjusting the boundaries of the districts so provisionally determined may be submitted, in the case of London and Home Counties not later than December 31st; and in the case of Mersey and West Lancashire, and North Wales and Chester not later than November 30th, 1920.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

A Maximum Load Indicator.

Could you or any of your readers advise me of any load-indicating device on the market in England for use in connection with determining the load on distribution transformers?

At present, so far as we know, various companies either make a practice of occasionally testing transformers, or if they use demand meters can check the load fairly closely. This does not, however, cover the case of lighting transformers very well, and some indicating device is needed to determine when the transformer has been subjected to a high temperature by reason of load conditions.

R. J. Beaumont,
Shawinigan Water & Power Co.

Montreal,
June 28th, 1920.

The Cost of Living in India.

I have just read Mr. Dykes's letter in your issue of May 14th, and whilst I agree with him as regards appointments which carry with them free quarters, he somewhat begs the question when he states that, as the results of his recent short visit to India, he is able to state with confidence that many young men of public school and university education willingly go out as assistants in merchants' offices at salaries one-half of that mentioned (*i.e.*, Rs. 1,000 per month). No doubt he does know of some such who have willingly come out, in ignorance, under such conditions, but he is careful not to say that he knows of any who were satisfied, after they had been out here for a few months, that they had been wise in coming. I myself know of men of the class he mentions who have been misled into thinking they were coming out to a good thing, and have since discovered their mistake, although in cases of big merchant firms which provide "chummeries" for their juniors to live in, the case may be different. Young engineers, as a rule, have to shift for themselves when they first come out, as it usually takes some time to get into an established "chummery."

There is, of course, more chance of advancement in India than at home, and I do not wish to discourage young men from coming out, but for a man "of public-school or university education" (*i.e.*, one who is used to keeping up "appearances" to a certain extent—a very necessary thing in India), the minimum salary should, generally speaking, be Rs. 700 per month. For a married man, Rs. 900 at least. I speak, of course, of the big Presidency towns, Calcutta, Bombay, and Madras, although the last-mentioned is a cheaper place to live in than the other two. Up-country, also, living is cheaper.

Regarding the last paragraph of Mr. Dykes's letter, it is not likely that British engineers will ever be ousted by Indians, although a few of the latter will no doubt continue to rise to high positions as in the past, but they will be the exceptions.

P. L. T.

Calcutta.
June 19th, 1920.

Staff Salaries and Conditions of Service.

I think that we are jointly to be congratulated upon having induced the S.T.E., in the person of its secretary, to emerge from its self-sought obscurity.

Mr. Wyld's letter in your current issue is extremely interesting, but I am afraid that it is merely a clever piece of special pleading.

Judged superficially, it appears convincing, but a critical analysis would appear to confirm my original views. From Mr. Wyld's letter it is easy to assume that he finds it difficult to judge of the relative importance of principles as compared with points of administrative detail. Mr. Waddington seems to be in the same plight, and fails to observe that my objection to the S.T.E. is not that it has not done anything, but that I was unable to discover that it had any principles to which I felt that I could honestly and whole-heartedly subscribe.

Further, and this is by way of being comment on the S.T.E.'s methods, although I am, in my proper person, well known to many engineers of all classes, and in daily and hourly contact with them, it was only eight months ago that I first heard of the existence of this wonderful society, which in a district where there are estimated to be at least some four to five thousand men eligible as members, has a membership of less than 200!

I quite realise, none better, that a big organisation takes time to build up, but all the time in the world will not be sufficient for the building up of an organisation which cannot discriminate between fundamentals and unimportant details.

To fight a great cause, it is necessary to inspire the rank and file of the movement with ideals or principles to which they can subscribe. The simpler in form and higher in character these are, the more successful the movement will be. In other words, what is required is a crusade.

Publicity spells life to good causes and, very often, death to poor ones, and by that test I, for one, am content to judge the S.T.E. That which is conducted in dark corners, and in secrecy, has only its authors to thank if it is classed with conspiracies instead of crusades.

In conclusion, I wish to emphasise that I have no desire whatever to "crab" the legitimate efforts of the S.T.E., and no one would be more pleased than myself to find that it is on the right lines.

However, I am not convinced by Mr. Wyld's letter that this is the case, especially as I am informed on good authority that the efforts of Mr. Wyld and his friends are almost solely directed towards political action, thus laying them open to temptations to form undesirable alliances with various labour organisations.

Garton le Roet.

July 15th, 1920.

About Condensers.

Would any reader kindly let me know details of any books, papers, &c., on the theory, design, and construction of static condensers, especially those for power purposes, *e.g.*, phase splitting on single-phase motors, power-factor improvement on A.C. systems, &c.?

Capacity.

Persia.
June 5th, 1920.

What is the Contractor Doing?

"British Manufacturer" asks why the contractor fills his window with American heating and cooking apparatus. The answer appears to me, as a contractor, to be obvious.

It is our duty to supply the consumer with what he wants in the form of apparatus which will not only do the work which it is required to do, but will also look artistic. The "British Manufacturer" has apparently forgotten that there is such a word as "Art." The American manufacturer not only remembers that word, but introduces it into his products.

When "British Manufacturer" learns this lesson, which he does not appear to understand at the present time, he may be quite confident that he will have the whole-hearted support of the contractor in disposing of his goods.

Live Wire.

July 19th, 1920.

[Several letters have been unavoidably held over to our next issue.—EDS. ELEC. REV.]

BUSINESS NOTES.

Midland Rates of Pay.—At a meeting held at Nottingham, on July 13th, basic rates and working conditions were settled by the Industrial Council for No. 7 East Midlands District, including South Notts, South Derbyshire, and South Lincolnshire, with the whole counties of Leicester, Rutland, and Northants. In fixing rates and conditions, the area was divided into two grades, large undertakings of over 5,000-KW. capacity, such as Nottingham and Leicester, being placed in Grade 1, and smaller plants in the second grade. The terms agreed upon will now be presented to the National Industrial Council for approval, and, it is expected, will come into operation as from August 1st next, a Committee being appointed to deal with any anomalies which may arise. It was determined that Burton-on-Trent and Mansfield should be directly represented upon the Council, thereby raising the number to 14 upon each side, representative of employers and employed.

Book Notices.—The July issue of *Conquest* contains, amongst a variety of interesting items, articles on "Electric Melting Furnaces," by F. Rowlinson; "Electrifying Seeds"; and a description of the punched-card system of dealing with statistics and commercial data, the Hollerith machine being electrically operated throughout.

"The Metropolitan-Vickers Gazette." Vol. VI. No. 87 (23 pp.). —The June number of the "Gazette" presents several long, interesting articles, including fully-illustrated descriptions of a new blast-furnace hoist and contactor-type starters for motor-driven air compressors.

"Polytechnic Institute of Brooklyn: Catalogue of the College of Engineering, 1920-21." (119 pp.) This volume describes the various departments and courses of the College, with the rules for admission, particulars of degrees conferred, &c.

"The Trend of Regulation," by the Hon. Carl D. Jackson, and "The Reward for Efficiency," by the Hon. Edward O. Egerton (24 pp.).—These are two addresses covering the financing of electric utilities and the regulation of public utilities given at the forty-third Convention of the U.S. National Electric Light Association.

"The Technology Reports of the Tôhoku Imperial University, Sendai, Japan." Vol I. No. 1 (100 pp.). Tokio: Maruzen Co.

"Vickers' News," Vol. II, No. 19 (16 pp.), containing articles on the "Cosmos" lamp works, London-Paris air service, submarine photography, &c., all fully illustrated.

"Scientific Paper No. 379 of the U.S. Bureau of Standards, "Reflecting Power of Monel Metal, Stellite, and Zinc." (4 pp.) Washington: Government Printing Office. Price 5 cents.

Amongst other publications of the Royal Institution of Great Britain that we have recently received are the papers on "The Gyrostatic Compass," read by Mr. S. G. Brown, F.R.S., on Jan. 30th; and "The Thermionic Valve in Wireless Telegraphy and Telephony," read by Prof. J. A. Fleming, F.R.S., on May 21st, 1920.

Sequestration.—JARDINE M'KERLIE, electrical engineer and contractor, 193, Crow Road, Partick, Glasgow, and residing at 2, Thornwood Drive, Partick, Glasgow.—Meeting of creditors at the Faculty Hall, St. George's Place, Glasgow, July 28th. Mr. J. L. Mackie, 62, St. Vincent Street, Glasgow, agent.

The British Industries Fairs.—The President of the Board of Trade has appointed a committee consisting of the following, viz:—Sir Frank Warner, K.B.E., chairman; Mr. W. A. Anderson, Mr. P. W. L. Ashley, C.B., Sir W. H. Clark, K.C.S.I., C.M.G., Mr. J. W. Murray, Mr. G. C. Vyle, and Major F. H. Wedgwood, to consider the best policy to be adopted in future as regards British Industries Fairs, particularly in respect of the centres at which they should be held, the trades which should be included, and the classes of exhibitors who should be allowed to participate. Mr. A. G. Chuter, M.B.E., of the Department of Overseas Trade, has been appointed secretary to the committee.

Health Exhibition.—The Health Exhibition at Bingley Hall, Birmingham (under the auspices of the Royal Sanitary Institute, which is this week holding its conference in that city), was opened on Monday by the Lord Mayor (Alderman W. A. Cadbury). The great hall was filled with stands of exhibits dealing with health, sanitation, and domestic hygiene. Electrical appliances constituted a good feature. A silver medal was awarded to the City of Birmingham Electricity Department, for a display emphasising the hygienic value of electrical appliances; and another was given to the Hoover Suction Sweeper Co., for electric sweepers. Bronze medals were awarded to Messrs. Charles E. Beck & Co., London, for the "Thor" electric washing machine; to the "Gem" Labour Saving Device Co., Manchester, for the "Gem" electric vacuum cleaner; and the Western Electric Co., Ltd., London, for an electric sewing machine.

Catalogues Wanted in New Zealand.—Makers of British lighting and power sets are asked to send catalogues and price lists in duplicate, together with particulars of terms, delivery, export arrangements, to H.M. Trade Commissioner, P.O. Box 369, Wellington, New Zealand, as there is a market there for these manufactures.

Inquiries.—Makers of the "Bowman Ashden" fly-wheel dynamotor and magnetic clutch brake are asked for.

Company Liquidations.—INSULATION AND METAL FITMENTS, LTD.—Winding up voluntarily. Liquidator, Mr. M Jenks, 6, Old Jewry, E.C.

Small Sets for Nairobi.—H.M. Trade Commissioner, Nairobi, East Africa, in a recent dispatch to the Department of Overseas Trade, mentions that there is a reasonably good demand in that country for small electrical power sets with battery.

Copper and Lead Prices.—MESSRS. F. SMITH & Co., report, July 20th:—Copper (electrolytic) bars, £111, £1 increase; electrolytic sheets, no change; electrolytic wire rods, £126, £1 increase; electrolytic H.C. wire, no change; silicium bronze wire, no change.

MESSRS. JAMES & SHAKESPEARE report July 20th:—Copper bars (best selected), sheets, and rods, no change. English pig lead, £37; 10s. decrease on last week's prices.

American Business Methods in Holland.—The following advertisement appeared in a Dutch Daily Newspaper last week:—

"AMERICAN MANUFACTURERS
of highest standing require
CAPABLE CONCERN as
SOLE REPRESENTATIVE
for First class **Motor Tractors with Ploughs** and **Motor Trucks.**
Both brands already introduced in this country.
Only those who have sufficient capital to carry stocks need apply."

Comment on the suggested financial arrangements is needless.

E.D.A.—We have received a further bunch of pamphlets from the Electrical Development Association. Couched in non-technical terms, these are designed to point out the advantages of "doing it electrically" to the lady of the house. Labour-saving is, of course, the main theme, and one of the leaflets—"Start the day the easy way"—demonstrates the benefit of electric kettles, toasters, &c. Another—"The beginning of a perfect day"—deals with electric cooking, and "Silent aids to comfort" emphasises the cleanliness and convenience of electricity.

French Manufactures.—The sixth display of articles manufactured in France is being given at the Office Commercial Français en Angleterre (French Commercial Intelligence Department), 153, Queen Victoria Street, E.C. 4, from July 15th to 31st. The objects of this organisation are principally to foster and develop Anglo-French commercial relations by procuring special information and giving all possible assistance to exporters. Its accounts are submitted annually to the French Ministry of Commerce, under whose auspices it operates. The present display is divided into three sections. The first comprises photographic apparatus, philosophical and surgical instruments, laboratory apparatus, &c. In this group are cameras, binoculars, compasses, barometers, altimeters, theodolites, &c., by well-known French companies; in all about 30 manufacturers are represented. A feature of this section is an explosive testing machine, made by L. Doignon, of Malakoff (Seine), embodying a small motor and other electrical accessories, but apart from this, and some electromedical apparatus, the electrical side is practically neglected. Group 2 exhibits perfumery, ornaments, jewellery, fancy work, small leather goods, brushes, &c., and the third section is devoted principally to literature —French commercial journals and reports.

New Belgian Company.—A new company has just been formed at Forest-lez-Brussels, with a capital of 1,000,000 fr. and the title La Société de la Soudure Electrique Autogene, to carry on an electrical-welding business. Among the directors of the new concern is Major James Caldwell.

French Companies.—The Société Force et Lumière Electrique (9, Rue de Rocroy, Paris) has acquired the Strassburg and Metz branches of the A.E.G. in Alsace-Lorraine.

The Société des Forges de Montalieu, with offices at 1, Avenue du Comte-Vert, Chembéry (Savoy), has been launched as a company for the acquisition, installation, and working of hydroelectric power, more particularly for use in the electro-metallurgical industry. Its capital is 400,000 fr.

There has been formed at Paris (60, Rue Michel Ange), the Société de Constructions Electriques et des Moteurs Triphasés Roux, with the objects indicated by its title. The capital is 300,000 fr.

Office Commercial des Fabricants Spécialistes de l'Industrie Electrique is the name of a company formed at Lyon (32, Rue de Marseille), with a capital of 100,000 fr., to further the interests of electrical manufacturers of special lines.

With headquarters at 4, Rue Rosenwald, Paris, Adrien Fieux et Cie. have established themselves as a company, with a capital of 115,000 fr., for the manufacture of electrical apparatus.

New Swedish Companies.—Among the new companies recently formed in Sweden in connection with electric lighting undertakings are the Hammerdals Elektriska Kraft Aktiebolag, of Hammerdals, and the Genea Elektriska Aktiebolag, of Stockholm.

Canadian Contracts: THE ADVANTAGES OF DIRECT REPRESENTATION.—The Provincial Governments and Municipalities throughout the Dominion of Canada frequently advertise locally considerable requirements in machinery and other supplies, and, since it often happens that the plant, &c., is urgently required by the time that the necessary expenditure is authorised, the period allowed for the submission of tenders is usually short. This is an old difficulty of British traders in their relations with other and more distant parts of the Empire as well. It may prevent British suppliers from submitting tenders, or at least place them at a very considerable disadvantage as compared with Canadian manufacturers and U.S.A. firms who for geographical reasons are more favourably placed.

The authorities concerned are fully aware of the position, but, while they appreciate that it is to their advantage that United Kingdom firms should tender and are anxious to give them every opportunity of competing, reasons of urgency, as already stated, often render impracticable an extension of the period allowed for the submission of tenders.

An effective way to surmount the difficulty is by having direct representation in the Dominion. Provided the agent has the desirable attributes for the position, and is given powers wide enough to enable him to act promptly in the interests of his principals the latter can enjoy all the advantages of a local house. The substantial accuracy of this statement is not infrequently confirmed in reports received in the Department of Overseas Trade. Quite recently the tender of a United Kingdom firm for motor lorries required by a Canadian municipality was accepted provisionally. The local agent of the tenderer was able to satisfy the municipal authorities that their stipulations would be met, and the tender was finally accepted. Not less important in point of value are some of the orders placed by private firms, and although speed in tendering may not in these cases be so essential to success, the services of a responsible agent who can, if required, conduct any necessary negotiations or inquiries in person are likely to be of considerable assistance to his principals in this country in their efforts to secure Canadian business. Among cases of successful tendering by United Kingdom firms recently reported to the Department of Overseas Trade may be mentioned:—

1. An order for a horizontal boring machine required by a Canadian firm was secured by a United Kingdom manufacturer with a branch house in Toronto.

2. A contract for copper pipe was obtained by a United Kingdom firm whose success is partly attributable to the efforts of their Montreal agent.

In both these cases the successful firm first heard of the opening through His Majesty's Trade Commissioners in the Dominions, who are often in a position to assist agents in their efforts to secure orders for their principals. United Kingdom firms who have not already done so are invited to communicate to the Department of Overseas Trade, 35, Old Queen Street, S.W.1, the names and addresses of their agents for the information of His Majesty's Trade Commissioners in Canada.

Private Meeting.—Hewett, Raine & Co., 41, Lewis Grove, Lewisham, London, S.E., electrical engineers.—The creditors interested herein were called together recently, at the offices of Messrs. Corfield & Cripwell, accountants and auditors, Balfour House, Finsbury Pavement, E.C., when a statement of affairs was presented which showed liabilities of £805. The indebtedness to the trade was £802, the balance being due to the bank. The assets are £987, or a surplus of £182. Mr. W. Osborne reported that the stock should realise favourably, while the book debts were generally good. Only a small amount was required to complete the work in progress. He added that the position was somewhat unusual. A business previously carried on at the same address under the style of Messrs. Chapman & Co. was purchased for £700, of which £300 was for the stock and the remainder for goodwill. The money for the purchase was found by two gentlemen, but one of them had never taken any practical interest in the concern, and was now travelling on the Continent. A third gentleman became identified with the business in July of the present year, but no further capital was then introduced. Messrs. J. C. Raine and S. Hewett had only drawn on the average a sum of £3 a week each. From the figures which had been prepared it appeared that the business had been conducted at a loss for some little time past, and the gross profits had not been sufficient to cover the establishment charges and the drawings. After a short discussion a resolution was passed in favour of the matter being dealt with under a deed of assignment, with Mr. W. Osborne as trustee. A committee was also appointed consisting of the representatives of Messrs. Falk, Stadelmann & Co., the Commercial Electric Accessories Co., and the General Electric Co.

Electric Steel Production.—Statistics recently published by the American Iron and Steel Institute show that while the total annual steel output of the country has about doubled in the last five years, the tonnage of electric steel has been increased twenty-fold. The electric process has passed the crucible and Bessemer processes for the production of alloy steels, and is almost equal to the open-hearth acid process.

The total capacity of the electric steel furnaces of the United States in 1919 was about 1,350 short tons. On the basis of three heats per day, operating 300 days per annum, these furnaces are capable of producing 1,215,000 short tons, on an 8-hour day basis. For continuous operation of 24 hours per day the annual capacity would be 2,025,000 short tons. Electrical steel furnaces in the United States increased from 155 in 1917 to 330 in 1919.

The results obtained in general average practice indicated that the electric furnace steel was uniformly better by a startling percentage. Due to the fact that electric steel can be poured at a much higher temperature in a still or dead condition, it has become possible to produce intricate thin-section castings with regularity and without a high percentage of rejections.

The demands of the Government on account of wartime requirements brought out requirements which could only be met by using the electric furnace. This naturally stimulated the industry and placed it on a firm foundation.—*American Machinist.*

Inter-Ally Electrical Engineering Developments.—A correspondent states that some important inter-ally electrical engineering developments are in progress. In November, 1918, there was formed in Paris a company with the title of La Société des Constructions Electriques du Rhone, to carry on an electrical engineering business, the concern acquiring through the English Electric Co., Ltd., the rights to use the patents of the Phœnix Dynamo Manufacturing Co., Ltd., Bradford; Dick, Kerr & Co., Ltd., Preston; the Siemens Dynamo Works, Ltd., Stafford; and Willans & Robinson, Ltd., Rugby.

Recently the title of the Rhone Co. was altered to that of the Société des Constructions Electriques de France, the capital being at the same time increased to 40,000,000 fr. It has also acquired the works at Tarbes of the Singrun Co. of Epinal, and has secured an important contract from the Midi of France Railway Co., in connection with the electrification of that company's system.

One of the other developments of the Rhone Co. was the formation some time ago of a Belgian branch under the name of the Société Auxiliaire de Constructions Electriques de Belgique. The Belgian concern, among other things, has secured an interest in the Compagnie Internationale d'Electricite, of Liége, the capital of which has been increased to 40,000,000 fr., and purchased the engineering business of the Anciens Ateliers Van den Kerckhove, of Ghent. To carry on these undertakings a new company has now been formed with the title Le Société des Constructions Electriques de Belgique, and arrangements are now in hand for the extension of the works both at Ghent and Liége.

The English Electric Co., Ltd., on its part has undertaken to technically assist the new concerns in the direction of railway electrification work, the construction of turbines, the equipment of tramway systems, the production of electric motors suitable for iron and steel rolling mills, mining and textile mill plant, signalling systems, telephone apparatus, cable and wire manufacture, &c. At the same time the French company will assist the Belgian undertaking in the direction of electric locomotives, and electro-metallurgy.

Applications for British Trade-marks.—Appended is a summary of the recent applications for British trade-marks in respect of goods connected with the electrical trades and industries:—

Bleriot-Phi (lettering combined with design). No. 307,872. Class 6.—Machinery for generating light for vehicles, ships, and boats. Bleriot, Ltd., 57-59, Long Acre, London, W.C. December 1st, 1919.

Eclat, British Made (lettering combined with design). No. 399,799. Class 13.—Electric lamps (ordinary), British made. R. Edghill and L. Schaer, 2, Woodchester Street, Paddington, London, W. January 21st, 1920.

Junghans I (lettering combined with design). No. 381,961. Class 13.—Electric pocket lamps and parts. Gebruder Junghans Gesellschaft, 134, Gaishaldenstrasse, Schranberg, Germany. September 13th, 1919.

Electrilac. No. 402,170. Class 50. Electrical insulating preparations. Arthur G. Brown, trading as the Rustnot Co., 73, Bridge Street, Manchester. March 23rd, 1920.

Prento. No. 400,479. Class 8.—Electrical distributing boards and electric bell indicators. Herbert B. Frentice, Progress Works, Crossland Street, Holbeck, Leeds. February 6th, 1920.

Gnome. No. 302,281. Class 6.—Electric machines, &c. Société des Moteurs, Gnome et Rhone, 11, Rue de la Boetre, Paris. June 3rd, 1919.

C.M.C. (monogram). No. 402,720. Class 8.—Electrical switchgear. Cleveland Metal Co., Ltd., Bridge Works, Bridge Street, Stockton-on-Tees. March 1st, 1920.

Lewcos. No. 401,894. Class 8.—Electric light flexibles and telephone flexibles. No. 401,896. Class 50.—Impregnated electric insulating tapes. London Electric Wire Co. & Smiths, Ltd., 7, Playhouse Yard, Golden Lane, London, E.C. March 15th, 1920.

Klik. No. 403,345. Class 13.—Electric accessories. The B.E. Co. (of London and Birmingham), Ltd., 57, Upper Thames Street, London, E.C. April 24th, 1920.

Mercure. No. 402,367. Class 18.—Electric generators for lighting and power purposes. Ward & Goldstone, Ltd., Sampson Works, Salford, Manchester. March 26th, 1920.

Bankruptcy Proceedings. — EDWARD STIRLING ELAM and JOHN WALTON, trading as Elam, Walton & Co., electricians, 63, King Edward Street, Kingston-upon-Hull.—The public examination of these debtors was held on 12th inst., at Hull. According to the debtors' statement of affairs the unsecured liabilities amounted to £336, and assets £111, thus disclosing a deficiency of £225. The debtor Elam attended, and the Official Receiver reported that the debtor Walton had written a letter to him saying he was in London, and was unable to return. This debtor's examination was therefore adjourned. With reference to Elam, this debtor stated that he joined the army in 1914, and was discharged on account of ill-health in 1918. He admitted that neither he nor his partner were electricians. The capital of the business was £40, which was found by Walton, and he (Elam) paid into it at different times portions of his pension. His total drawings from the business were only £31 10s. In February they opened a branch shop in Aivlaby Road. He attributed their failure to want of capital, inexperience, and loss through fire. The examination was closed.

MELLON, W. H. (lately trading as H. B. Wallis & Co.), electrical engineer, Chiswick.—Last day for receipt of proofs for dividend, August 5th. Trustee, Mr. T. Gourlay, 14, Bedford Row, W.C. 4.

Foreign Goods in British Catalogues. — H.M. Trade Commissioner at Wellington, New Zealand, writes that he is continually receiving complaints from local firms which arise from the inclusion in British catalogues of details of foreign goods without any indication that they are foreign. When it is found out in one case it naturally leads to a doubt as to whether any of the goods in the catalogue are British, and in a country such as New Zealand, where sentiment is strongly British, harm is undoubtedly done to the trade of the firm concerned. The extra import duty to be paid on goods of foreign origin above the preferential tariff on goods of United Kingdom manufacture has also to be taken into account.—*Board of Trade Journal.*

Liverpool Cable Jointers' Strike. — Our Liverpool correspondent writes: The strike of the Liverpool Corporation cable jointers and street box examiners, members of the Electrical Trades Union, and navvies employed in excavating for the laying of electric mains, drags on into the ninth week, and no steps appear to be taken to arrive at a settlement. It is and has been competent since May 17th, when the strike was initiated, for any eight trade union representatives to call a special meeting of the District Council to be held within seven days, but no such action has been taken. The grievance of the men is that they have not participated in the awards granted to certain grades employed at Liverpool and certain other towns, and their demand is that they should benefit to the full. The recommendations have been accepted without question throughout the north-western area except the grades now on strike at Liverpool. Instead of challenging the decision, and their representatives asking for a meeting of the District Council to discuss the matter, the men ceased work about May 17th. The representatives of the men then asked for a meeting of the District Council, but neither were the employers' representatives nor, in fact, several of the trade union representatives, willing to attend a meeting prior to the men now on strike returning to work. Thus, although there exists machinery for dealing expeditiously with any dispute as it arises, unless the rules are observed, it might as well not exist.

Writing later, our correspondent reports that the strike has extended to the Wallasey and Birkenhead Corporations.

The French Jeumont Works.—The report of the directors of the Ateliers de Constructions Electriques du Nord et de l'Est (Jeumont-Nord) is accompanied by accounts for the past six years, circumstances having rendered it impossible for balance sheets for the years of war to be submitted at an earlier date owing to the late enemy occupation of the works at Jeumont. It is possible for the company to pay two dividends for this period of years, namely, 4 per cent. out of net profits of 3,677,000 fr. for 1917, and 5 per cent. out of 2,200,000 fr. for 1919. The report states that despite the reduced activity during the war the results had permitted the company to make the normal rate of depreciation, and also form a provision fund of 2,000,000 fr. These results were achieved, thanks to the old workshops at Saint-Ouen, the shops rented at Bezons during the war, and the establishments purchased at Saint-Denis in 1916. The company was, therefore, about to approach a period of activity with a well-established financial situation, which was of the greatest importance in view of the high cost of labour and raw materials.

Immediately after the armistice, the report states, the directors devoted their attention to the recovery of the plant removed by the German armies. Working at Jeumont was begun as soon as circumstances permitted. The foundries for pig iron, steel, and bronze were restarted at the beginning of 1919. In the case of the engineering shops it was necessary to wait for the restoration of the railway before the machinery recovered could be transported, together with the replacement of machinery purchased during the war. The machinery recovered, which had been worked intensively by the Germans, had to undergo considerable repairs, and a certain number of machine tools had to be refused. Nevertheless it was possible to consider the shops as reconstituted as from September, when 40 machines were still missing, but most of these had since been returned. The cable factory, the wire drawing mill, the rolling mill, and the factory for insulating materials had experienced a more complete devastation than the workshops, and the recovery of the plant and resumption of working required a longer time. Some idea of the quantity of plant removed could be gathered from the fact that until the end of April, 1920, 340 machines, necessitating the use of 112 railway trucks, had been returned by Germany, and there still remained to be restored important cable-making plant which the Germans had sold to an Austrian firm, and for the return of which over 40 wagons would be needed. The erection of the rolling mill was proceeding, and it would soon be put in operation again, while the wire mill recommenced working at the end of 1919, and was now in full operation. The factory for tubes and moulded insulating materials had yet to be re-established. As a result of the reconstruction of the works at Jeumont those at Saint Denis had been specialised for the construction of low and high tension apparatus, and as soon as the remainder of the plant was restarted, the productive capacity of these two works would be considerably greater than that in 1914. In conclusion, the report mentioned that the orders on hand for the different departments were numerous, and would find full occupation for them for a long time forward.

Baron Empain (chairman), replying to questions at the recent annual meeting, stated that the sum of 14,000,000 fr. provided for depreciation was not high, having regard to the almost worn-out condition of the recovered machinery and the necessity for having up-to-date machine tools in order to produce cheaply. The claims for war damages amounted to 29,466,000 fr. on the basis of pre-war prices, of which 16,680,000 fr. had been paid by the Bureau of Industrial Reconstruction. As to the present position of affairs, the chairman remarked that the situation was very favourable from an industrial point of view; orders were abundant at satisfactory prices, and supplies of raw materials were assured on appropriate conditions, the only obscure question being that of labour, the fluctuations in which had been considerable. The directors, however, had guaranteed themselves as much as possible against losses from this situation of labour, and they believed they had been successful in this respect.

The Demand for Machinery in China.—In connection with the presence in this country, on a visit, of Mr. H. H. Fox, C.M.G., Commercial Counsellor of H.M. Embassy in China, the Board of Trade *Journal* publishes an article on "The Chinese Market: Outlook for British Trade." In the course of this contribution the writer comments as follows on the demand for machinery: "This industrial development has naturally created a demand for foreign machinery, which, owing to the cessation of supplies from Europe and latterly from America caused by the war, has now assumed very considerable dimensions. From all parts of China come orders and inquiries for textile machinery, railway material, electric light and power plants, motor cars and lorries, which our engineering firms are unfortunately only able to cope with to a limited extent, as they have difficulty in obtaining fixed quotations and guarantees of delivery from manufacturers in the United Kingdom, who are apparently fully occupied with home orders. This is particularly regrettable in view of the enormous expansion in the engineering trade of China that is bound to take place within the next few years, and the keen competition on the part of the Americans, Germans, and Japanese. It is desirable that home manufacturers with an eye to the future could see their way to give priority to some orders at least from China in order to keep British manufactures before the Chinese. It must be remembered that machinery being still comparatively rare in China, each complete equipment of, say, a cotton mill or an electric light plant, attracts far more attention than it would in countries where industries are more highly developed, and, indeed, serves as the best of all advertisements for not only the particular maker of the goods, but for the manufacturers of the maker's country in general."

London firms who are desirous of consulting Mr. Fox while he is in this country should communicate with the Department of Overseas Trade, 35, Old Queen Street, S.W. 1. He will be touring certain industrial areas in the United Kingdom, during the months of September and October.

Swedish Enterprises in Holland.—Supplementing the information contained in the present annual report of L. M. Ericsson's A.B., it is now stated that the company's new subsidiary in Holland bears the title of the Nederlandsche Ericsson Telefon Fabricken, and has a share capital of 3,000,000 florins, of which the parent company holds about two-thirds. The Swedish company has received some large orders from Holland. Among these is mentioned one for a modern telephone exchange for 5,000 subscribers on the Hultman automatic system, for the communal local telephone company in Rotterdam. It is said to be probable that the company or its Dutch subsidiary will also receive the orders which will result from the conversion to the automatic system of the whole telephone service in the city. A contract has also been booked for an interurban exchange in Rotterdam for the Dutch State Telegraph Administration, which it is calculated will be one of the greatest and most modern in the world. The company is also about to erect three other exchanges in Holland, whilst various sections are to be established in Java and Sumatra.

Catalogues and Lists.—THE BRITISH ELECTRICAL PLANT CO., LTD., 66, Carrick Street, Glasgow.—A well-produced catalogue (55 pp.) of A.C. motors—squirrel cage and slip-ring induction types—including illustrations and a great amount of useful information. A table of metric equivalents is also given.

THE A. & A. ELECTRICAL CO., LTD., 13, Farringdon Road, E.C. 1. —An illustrated and priced leaflet listing various types of bulbs for automobile lighting from 2 to 48 C.P.

THE GENERAL ELECTRIC CO., LTD., 67, Queen Victoria Street, E.C. 4.—Catalogue S (2) section (20 pp.), an illustrated and priced list of "H. and H." Hart-snap switches of various types and applications. Heater, electrolier, and Continental type switches are included, and wiring diagrams are also given.

THE LEA RECORDER CO., LTD., 28, Deansgate, Manchester.—Leaflet C2, illustrating and describing totally-enclosed "Lea" V-notch meters for measuring boiler feed water.

MESSRS. SIEMENS BROS. & CO., LTD., Palace Place Mansions, Kensington Court, W. 8.—Pamphlet A 707, an illustrated description of a ship's navigation lights indicator, complying with the requirements of Lloyds for electric navigation lights.

MESSRS. PRITCHETT & GOLD and ELECTRICAL POWER STORAGE CO., LTD., 50, Grosvenor Gardens, Victoria, S.W. 1.—A well-produced catalogue (64 pp.), containing useful notes on electrical power storage, battery-booster plants, &c., describing and illustrating various types of secondary cells and batteries, and giving photographs of installations.

MESSRS. JOHNSON & PHILLIPS, LTD., Charlton, S.E. 7.—A description (8 pp) of six switchboard installations giving a general view in each case. Boards erected for the Sydney municipality and the L.C.C. tramways are included.

THE ELECTRICAL SUPPLIES CO., "The Lighthouse," 233, Tottenham Court Road, W. 1.—A price list of "Univeral" electrical appliances, illustrating irons, kettles, &c.

MESSRS. GEORGE KENT, LTD., 199-201, High Holborn, W.C.—A list complete to May, 1920, of "Venturi" meter installations (36 pp.).

ENTERPRISE MANUFACTURING CO., LTD., Gun Street Electrical Works, Bishopsgate, E. 1.—A priced and illustrated leaflet dealing with ironclad switch and fuse gear from 30 to 200-ampere capacity.

Annual Outings.—On Saturday, July 10th, the staff and employés of the firm of STEGMAN & CO., Clapham Junction, spent a long day at Brighton. The company numbered more than 30. Dinner was provided at the Queen's Hotel. The chair was occupied by Mr. W. H. Mansell. The arrangements for the outing were carried out by Mr. H. T. Mitchell, who acted as steward. The toast "Success to our Firm" was well received.

On Saturday, July 10th, the employés and staff of the SOUTH WALES ELECTRIC WELDING CO. held their annual outing. They proceeded from Swansea by train to Llanwrtyd Wells, where sports were organised.

The annual outing of the C.E.C., LTD. (THE CITY ELECTRICAL CO.) was held on Saturday last, when a char-à-bancs tour of the Surrey Hills was made. In the morning trip, Great Bookham, Merrow Downs, Newlands Corner, The Silent Pool Albury, Shere, Gomshall and Dorking were visited. At lunch the opportunity was taken to make a presentation to Mr. H. E. Ellis, the managing director and founder. The present took the form of a large Seascape, by R. Weignal, R.A., with a suitable inscription plate. Mr. Ellis, in acknowledging, welcomed back those who had returned from the war. The toast of "The Firm" was replied to by Capt. H. E. O. Ellis, M.C., late R.C. and R.F.C. The toast of "The Ladies" was proposed by Capt. H. V. Ellis, late R.A.F.

Catalogues Wanted at Mombasa.—THE MOMBASA ELECTRIC LIGHT AND POWER CO., LTD., P.O. BOX No. 104, Mombasa, E.A.P., asks us to request manufacturers and factors of the following goods to send them catalogues and illustrated literature :—

Steam, gas, oil, and electric power plant (engines, dynamos, and auxiliaries).
Switchboards, switchgear, and instruments (A. and D.C.).
Wires and cables, bare copper, V.I.R. asbestos insulated, paper-covered, and lead-sheathed, steel-tape armoured.
Electric lighting fittings and accessories of every description.
Overhead transmission gear and materials of every kind.
Engineers' stores, machine tools, &c.

Cable-Makers' Strike Ballot.—A meeting of representatives of the Executives of the Workers' Union, the National Federation of Women Workers, the Electrical Trades Union, the India-Rubber Cable and Asbestos Workers, the National Union of General Workers, and the National Amalgamated Union of Labour—all connected with the cable-making industry—has decided to take a ballot of their members in the industry on the question of a strike to enforce the claim made on the Cable-Makers' Association. The claim is for 15s. per week for all employés over 18 years of age, and 7s. 6d. per week for those below 18 years of age. An offer has been made by the employers which is regarded by the Unions as totally unsatisfactory.—*Daily Herald.*

French War Profits Concealment.—M. Victor Euricult, telephone apparatus manufacturer, has been condemned to three months' imprisonment and the payment of a fine of 10,000 fr. for concealing a sum of 1,698,944 fr. war profits. It transpired on investigation, that while in 1911 his profits on supplies to Government totalled only 153,000 fr., in 1917 his firm netted 1,135,000 fr. of profits. Exalted military or civil personages are assumed to be mixed up in the business.

Trade Announcements.—MESSRS. W. CANNING & CO. LTD., of Birmingham, have completed the extension of their engineering works which are now fully organised for dealing with mass production of dynamos and polishing lathes. It will be remembered that in August, 1918, their engineering department was completely burnt out, and the new works are fully equipped with the latest machine tools. The new works have a capacity four times that of the old ones.

The business of MESSRS. ALLEN & PARKES, 15, Summer Row, Birmingham, will be carried on as usual under the same name. The dissolution of partnership referred to in our last issue related to the retirement of Mr. A. J. Allen from the firm.

THE JOSEPH DIXON CRUCIBLE CO. have appointed Mr. C. R. Averill (28, Victoria Street, London, S.W. 1) as their sole agent for the United Kingdom for their graphite products.

Annual Holidays.—The works and offices of MESSRS. HIGGS BROS., Birmingham, will be closed for the annual holidays from July 30th till August 9th. Correspondence will not be attended to during that period.

The works of MESSRS. J. H. TUCKER & CO., LTD., Birmingham, will be entirely closed from Friday evening, July 30th, until Monday morning, August 9th, for the summer holidays.

The offices and stores of the NEWMAN ELECTRICAL CO., Newman Street, London, W. 1, will be closed from Saturday, July 31st, until Saturday, August 7th (inclusive) for the holidays. Urgent correspondence will receive attention.

The works of MESSRS. WARD & GOLDSTONE, LTD., Salford, will be closed for the summer holidays from July 26th to August 2nd inclusive. The offices, stores and packing departments will be open as usual to deal with correspondence and orders.

The works of the MIDLAND ELECTRIC POWER INSTALLATION CO., Wolverhampton, will be closed from Friday night, July 30th, until the morning of Monday, August 9th, for the August holidays.

The Trafford Park works and offices of the METROPOLITAN-VICKERS ELECTRICAL CO., LTD., will close down for the annual holidays on Friday, July 23rd, and will re-open on Tuesday, August 3rd. A small staff will attend to important matters.

The London offices of the CITY ELECTRICAL CO. will be closed from July 31st to August 9th. No correspondence will be attended to, but a small repair staff will be in attendance for urgent matters. Works telephone : "North 365."

Dissolution of Partnership.—CLIFFORD BUTLER AND CO., electricians and electrical engineers, 7 and 9, St. Peter's Gate, Nottingham.—Messrs. C. Butler and T. L. Hancock have dissolved partnership. Mr. Butler attends to debts and continues the business.

LIGHTING AND POWER NOTES.

Barnsley.—LOAN SANCTION.—The Town Council has received sanction to a loan of £36,250 for the installation of new plant at the electricity works.

Bath.—INCREASED LOAN.—In order to meet the additions to costs which have been incurred since the original estimate of the cost of extensions at the electricity works, the Electric Light Committee recommends application for a further loan of £7,712, making a total of £38,117.

Bridlington.—YEAR'S WORKING.—The statement of accounts for the year's working up to March 31st last shows a net deficit of £1,015. In spite of this, however, there is still a balance of £686 to the credit of the undertaking, which has not cost the ratepayers anything since its inception.

China.—ELECTRICAL DEVELOPMENT.—There are only 168 electrical undertakings in China, 49 of which are under foreign management. The Japanese have invested over $100,000,000 in such enterprises through the South Manchurian Railway Co., and $759,000 through other concerns; and the British have invested $25,000,000, of which about half is through Chinese concerns. In Canton there are 22 power and light companies, in addition to the British Tramway Co. No water power is used, most of the power being derived from oil, except for two coal-burning plants. They are all small, only four having a capacity of over 1,000 KW. There are also electrical enterprises in Kiangsu Province, centred around the city of Shanghai, which develop twice the power of the Canton plants. All of them use steam power. Of the 15 electrical companies in Shengking Province, Manchuria, 13 are managed and owned by the Japanese, and the 30,000 KW. of power generated is supplied to Chino-Japanese industry or transporation enterprises. The largest single enterprise is the No. 1 Power House of the railway company, which generates 4,500 KW. by steam. Although Shantung Province is one of the most populous areas in China, there are but four Chinese and one Japanese plants, generating a total of but 5,000 KW. In the other provinces there are only the small native plants using gas power and operating on a very small scale.—*Journal of Electricity.*

Chester.—YEAR'S WORKING.—The total income of the electricity department for the past financial year amounted to £35,893, as compared with £27,512 for the previous period. The total expenditure was £25,088, as against £16,750, leaving a gross balance of £10,805 (£10,762). The payment of loan and sinking fund charges, &c., resulted in a net profit of £1,076. The revenue accruing from the hydro-electric works amounted to £4,483, and the capital expenditure upon this plant was £18,482. A grant of £200 was made towards the expenses of the Dee inquiry.

Chipping Norton.—PUBLIC LIGHTING.—Upon the invitation of the Lighting and Watch Committee, the local gas and electric light companies submitted tenders for public lighting. The Council accepted the offer of the electric light company to carry out the work for £300.

Continental.—FRANCE.—The Municipal Council of Paris has accepted the proposal that a competition shall be held at which plans shall be submitted for the greater utilisation of the motive power of the Seine.—*Financial Times.*

ICELAND.—The first annual report of the Danish-Icelandic Installation Co. (Dansk-Islandsk Anlaegs-Selskat), of Copenhagen, which was formed last year for the acquisition of water-power rights and iron ore concessions in the north-western peninsular of Iceland, states that Mr. Houth, a Norwegian hydraulic engineer, was engaged to investigate and report on the water-powers in the area of the concession made to the company. As a result of his investigation, the engineer concludes that the water-power available would yield 35,200 turbine horse-power, or about 33,000 electrical horse-power on the average throughout the year. It is proposed to utilise the power for the winning of sale from sea-water, the smelting of iron ore, the fixation of atmospheric nitrogen and general supply purposes. It will, however, be necessary to raise additional capital to proceed with the work, but the financial situation is not considered to be favourable at the present time for appealing to the market. The Prime Minister of Iceland has intimated that a Government guarantee of the share capital may possibly be given.

ITALY.—At 10 o'clock on the night of July 14th, Rome was suddenly plunged into darkness by the cessation of work on the part of employés of the gas and electricity works. The workers are claiming a substantial increase of wages.

RUSSIA.—PEAT FUEL.—At Shatura, some miles from Moscow, a successful experiment on a small scale has been made in generating electricity by burning peat in adapted marine engines and boilers, and a scheme for building large generating stations in the peat districts has now been prepared.—*Daily News.*

Dundee.—NEW PLANT.—The Corporation Electricity Department has resolved to get only one turbine for extensions, instead of two, as the makers said that the necessary two could not be delivered in less than 22 months, whereas if only one turbine was ordered, there was every hope that it might be in use in 11 months.

Faroe Islands.—ELECTRICITY SUPPLY.—It is reported from Thorshavn, Faroe Islands, that an electricity works is to be established for Thorshavn in the near future. The technical manager of the Town Council has been in Copenhagen in order to make the necessary arrangements.

Grantham.—PRICE OF SUPPLY.—The Town Council has decided to oppose the application of the Urban Electric Supply Co. for the maximum price of electricity to be increased from 7d. to 1s. 2d. per unit, with a charge of 10d. per unit for lighting from July 1st.

Hereford.—DECREASE IN OUTPUT.—It was stated at a recent Council meeting that the number of units sold during the past financial year had dropped from approximately four millions to slightly over two millions, causing a decrease in revenue of £10,200.

Heckmondwike.—YEAR'S WORKING.—At a meeting of the District Council it was stated that a profit of £720, or of £1,491 if a disputed charge was taken into account, had been made on the electricity undertaking. The previous year had shown a loss of £1,534.

India.—HYDRO-ELECTRIC PROJECT.—The Sutlej Hydro-Electric Scheme was referred to at the Punjab Engineering Congress of 1919 in a paper on "A Project for Providing the Punjab with a Cheap Supply of Electric Power," by Mr. F. L. Milne, A.M.I.E.E., electrical engineer, Simla, from which the following is an extract:—The Sutlej River takes a big hair-pin bend from Oel to Kirithpore. The distance round through the Bhakra Gorge is some 40 miles, while across it is only some seven miles, but a range of mountains, the top of which is 3,400 ft. above sea level, intervenes. Therefore to get across this gap, a tunnel 10,500 ft. long is needed, ending in an open cut and forebay. From this forebay steel pipes can be laid to the power house 3¼ miles away. After deducting losses of head due to friction in the pipes, 300 ft. working head remains for the turbines. With a minimum supply in the winter of 2,700 cb. ft. per second, it is estimated 60,000 KW. can be generated. If, however, the Bhakra Dam is built, the requirements of the canals below will entail that never less than 7,500 cb. ft. per second must be passed down so that 150,000 KW. will probably be the ultimate output of this scheme. The power generated, if the scheme develops, will be used to electrify the Simla-Kalka Railway, provide light and fans at Ambala, and probably power to the mills there, light to the hill stations of Kasauli, Dagshai and Subath, power possibly for pumping from tubewells in tracts of Patiala and Nabha not served by canals, and for electrical extraction of metals from ores in the neighbouring Himalayas. There may also be possibilities of extension to Delhi, Amritsar and Lahore.—*Indian Textile Journal.*

Isle of Wight.—PROPOSED PRICE INCREASE.—In consequence of the application of the Isle of Wight Electric Light and Power Co. to the various Councils concerned for permission to increase charges, Sandown and Ventnor have decided to enter a protest, and Shanklin has acquiesced to the increase.

King's Lynn.—YEAR'S WORKING, &C.—At a meeting of the Town Council, on Wednesday, the Electricity Committee presented accounts for the year ended March 31st last, showing a surplus of £1,219, as compared with £1,924 in the preceding year. It was agreed, on the recommendation of the Committee, to use £525 to meet capital expenditure for which no loan had been obtained, and to carry forward the remainder to the next account. It was further reported that of the £60,498 expended to date on works and plant only one-fifth now remained unpaid, but considerable expenditure was about to be incurred for extensions, mainly necessitated by demands for power for the shipyards recently established on the west side of the river, to meet which an A.C. turbo-generator is to be installed and a submarine cable laid across the harbour, with a transformer sub-station on the west bank of the river.

Kinsale.—LIGHTING CONTRACT.—The District Council has accepted the tender of Messrs. O'Neill & Sons for supplying electric light to the town for three years at a charge of £180 per annum.

Lancashire. — JOINT AUTHORITY. — A Conference of electricity undertakings in Mid-Lancashire district was held at Preston, on July 16th, when the following resolution was passed:—"That a Committee be appointed, consisting of one member of each body of authorised undertakings, with the respective engineers, to consider and report to a future Conference as to the preparation of a scheme, or schemes, for improving the existing organisation for the supply of electricity in Mid-Lancashire district, including, if considered desirable, the formation of a joint electricity authority for the district." Mr. A. Howarth, Town Clerk of Preston, was appointed secretary.

Lowestoft.—HOUSE LIGHTING.—The Electricity Committee has agreed to a scheme submitted by the engineer for laying cables to the housing site, Beccles Road, at an estimated cost as follows:—Distribution, £1,230; services to houses and connections, £970; public light, £260; feeder cable, £1,350; contingencies, £190—a total of £4,000.

LOAN SANCTIONED.—The sanction of the Electricity Commissioners has been received to borrow £3,706 for the purchase of new plant. The term of repayment is 15 years.

Lincoln.—PLANT PURCHASE.—The Town Council has purchased from Stockport Town Council a 2,000-KW. turbo-generator set for £10,000.

Liverpool.—WAGES.—The Corporation has adopted a recommendation of the Tramways Electric Power and Lighting Committee that, pending the decision as to the new schedule of salaries for technical staffs of electricity supply undertakings submitted by the Joint Board of Employers and Staff Members of the Electric Supply Industry, payment under the E.P.E.A. awards be continued from May 21st to those members of the staff of the electric tramway, power, and lighting departments to whom the same has been made payable by previous resolutions of the Council.

Leigh (Lancs.).—YEAR'S WORKING.—The accounts for the year ending March 31st last, show an income of £26,263, compared with £23,296 for 1918-19. The working expenses amounted to £18,395, compared with £18,936, leaving a gross profit of £7,868, as against £4,360. Loan charges, new meters, &c., absorbed £6,651, leaving a net profit of £1,217, as against a deficit of £1,740 in the previous year.

London.—BATTERSEA.—The Electricity Committee has undertaken the conversion of 364 gas-light standards for electric 100-watt lamps. The estimated cost of the work is £3,755, and the annual maintenance charge £5 10s. per lamp.

GREENWICH.—A battery for the operation of the main switches is to be installed at the power station at an estimated cost of £400.

FULHAM.—The accounts of the electricity department for the year ended March 31st last, show an excess of income over expenditure amounting to £13,644, making, with the balance brought forward from last year, £19,814. This is to be distributed as follows:—To reserve, £5,000; to rate relief, £5,000, and the balance (£9,814) is to be carried forward to the next accounting period.

Lymington.—PRICE OF SUPPLY.—The Council has decided to oppose the application of the Electric Light and Power Co. for the charge for electricity to be increased from 9d. to 1s.

Newcastle (Co. Down).—LIGHTING CONTRACT.—The Urban Council agreed to renew the lighting contract with the Irish Town Light and Power Co. for one year at £340—being an increase of £110 over the previous contract.

Price Increases.—Increases in the charges for electricity have been, or are being, made in the following districts:—Ashton-under-Lyne, Barnsley, Chesterfield, Dalkeith, Derby, Hull, King's Lynn, Newcastle-under-Lyme, Stafford, West Ham, and Weymouth.

Pembroke (Co. Dublin).—Electricity Supply.—The experts called in to advise the Council on the best means of providing electricity for the district recommend that a supply be given by the Tramway Co. The latter is agreeable to this course, and the scheme is to be laid before the Electricity Commissioners for their approval.

Rochdale.—Small Plant.—The Health Committee has decided to expend about £230 on a small electrical plant for lighting Wolstenholme Hall.

Seaford.—Electricity Supply.—Messrs. Bedford & Co. having communicated with Commissioners regarding a proposed supply of electricity to the town and Newhaven, the Urban District Council has asked that it shall be consulted before powers are granted to a private company.

Sheffield.—Electricity Charges.—At the City Council meeting held on July 14th, a protracted discussion arose upon the suggestion to charge for electricity for power and lighting on an equal basis. Alderman Hobson predicted a great loss of industry to the city if the drastic step proposed was taken. Steel manufacturers would erect works in Sweden where hydro-electric power could be obtained at a very low cost. It was eventually decided to appoint a special committee to deal with the question under the chairmanship of the Lord Mayor.

Loans.—The Electricity Committee has authorised the town clerk to apply to the Electricity Commissioners for sanction to the borrowing of the sums of £250,000 for mains, £120,000 for sub-stations and transformers, and £30,000 for services.

South Africa.—Cape Town.—The report of the Mayor for the year 1919, states that during the war period renewals have been almost impossible to secure; every unit has been running constantly up to maximum load, so that a severe strain has been placed upon the generating plant. In November, 1918, orders were placed for two large boilers, and although it is hoped that one of the boilers will arrive this summer, there is no guarantee, and if the boiler is not delivered the position at the station during the next winter will be a serious one. It is only during the summer months that the work of installing new boilers can be undertaken. An additional 3,000-kw. alternator has also been ordered, the manufacture of which has been delayed owing to strikes in England, but it is hoped that within the next six or nine months this machine will be received, erected and placed in commission. Cable ordered in March, 1917, and for which the lead required for the sheathing was dispatched from Cape Town in 1918, remained undelivered at the close of the year, notwithstanding the fact that the order was supported by the Railways and Harbours Administration and everything possible done to secure priority. This will illustrate the delay which ensues in the delivery of material, for in pre-war days similar cable was delivered in 12 weeks from receipt of notice. On January 6th, 1919, the 3,000-kw. alternator broke down, due to over-heating; the 2,000-kw. machine was at the same time out of commission owing to the non-arrival of spare parts. The city was thus left with generating plant of a capacity less than in 1912, whereas the load was approximately 160 per cent. greater. This created a very serious position at the power station, and an extraordinary effort was required to avoid a calamity. The city electrical engineer, with commendable ingenuity and resource, built up from the available parts a machine that enabled the department to carry on. The experiment proved an entire success, and the improvised machine greatly assisted in overcoming the difficulties.

The Town Council has authorised the expenditure of approximately £4,000 as an extension of an existing contract with Messrs. Reyrolle & Co., of Hebburn-on-Tyne, for switchgear for district sub-stations. The Council has also approved of the proposal of the city electrical engineer to provide duplicate high-tension mains from Claremont to Muezenberg and tranformers for Muezenberg sub-station. The cost of the proposed scheme is estimated at £48,180, less estimated sale value of existing plant, buildings, and overhead lines between Wynberg and Muezenberg.

Warrington.—Extensions Sanctioned.—The Electricity Commissioners have sanctioned the borrowing of £150,000 by the Corporation to enable it to carry out the initial part of the extensions to the electricity undertaking.

West Ham.—Linking-up.—The Council has agreed to the proposal of the Electricity Commissioners to interconnect with the East Ham, Barking, and Ilford undertakings.

Weymouth.—Year's Working.—The financial result of the working of the Corporation's electricity undertaking for the year ended March 31st last was a loss of £680.

Yarmouth.—New Plant.—The Council has accepted the tender of the Brush Electrical Engineering Co. for a 1,400-kw. turbo-generator, at £20,710; 500-kw. frequency changer, £4,902 10s.; and of the General Electric Co. for a 500-kw. rotary converter, at £3,838. In February the cost of modernising the plant would have been £40,000, but by May and June the cost had risen to £60,000. The electrical engineer said that the immediate expenditure was to have been £44,000, but they were advised that a further sum would have to be expended, making a total of £60,000.

TRAMWAY AND RAILWAY NOTES.

Blackburn.—Sunday Service.—After being suspended since August, 1918, the Sunday morning service of tramcars was resumed on July 11th, though on modified lines, a 40-minute service being run on some routes.

Bolton.—Threatened Strike.—Subject to a joint conference being unable to arrange terms, Bolton is in danger of a new type of strike. The tramwaymen have threatened, if their demand for wages to be increased to the Rochdale level is not met, to strike on Saturday, July 24th, and on every subsequent Saturday until they get what they want. By this method the men would only lose one day's pay, whereas the loss in revenue to the department would probably amount to as much as on any two other days.

Bradford.—Fares and Expenses.—The question of increasing the tramway fares has been deferred. It is stated that if the fares remain on the present basis, the Tramways Committee will be faced with a deficiency of £62,200 at the end of the year. Very heavy equipment expenses are to be incurred to bring the system up to its pre-war state of efficiency, and the great importance attaching to the subject influenced the Council to give it the fullest consideration.

Canada.—Hydro-Electric Railways.—In a recent report to the Hydro-Electric Power Commission of Ontario, Mr. W. S. Murray, consulting engineer, New York, presented his conclusions arrived at after an exhaustive inquiry into various aspects of the proposed construction of railways to be supplied from hydro-electric plant. The report deals with the suggested Toronto and Bowmanville, the Toronto, Hamilton and Niagara Falls, and the Hamilton, Guelph and Elmira radials. Mr. Murray based his ideas of electrification on the London and Port Stanley route, which is actually in operation. The main points dealt with are, first, to consider whether any existing steam or electric routes would be duplicated under the proposed scheme. Secondly, to ascertain if the proposed lines would be adequate, and if their construction could be carried out at the figures estimated by the Commission's engineering staff, and, lastly, to discover if the estimated income was reasonably computed and sufficient to cover interest, sinking fund and maintenance charges. After dealing with details of many important parts of the projected routes, Mr. Murray arrives at the following conclusions:—(1) The estimates submitted by the Commission's staff for construction and operation are conservative. (2) The lines are admirably located, having due regard to the density of passenger and goods traffic in the districts to be served. (3) Existing lines will not be duplicated. (4) The decision of the Commission not to proceed with the construction of these railways at present, owing to the inflated prices of materials, is concurred with. (5) It is recommended that the Commission proceed with the full development of its plans applying to both finance and construction, in order to be in a position to acquire existing lines and property as may be economically purchased, and which will later form parts of the systems. The report further expresses the opinion that the excellent opportunities of industrial and civic expansion are being retarded at present by inadequate transportation facilities.

Continental.—France.—By a decree of June 2nd the Boulogne Chamber of Commerce is authorised to contract a loan for 3½ million francs for the construction of an underground railway connecting the Loubet Dock with the Nord Railway. This project has been in abeyance since 1913.—*Board of Trade Journal.*

Japan.—Railway Electrification.—The railway authorities in Japan have decided to substitute electricity for steam on all lines. A Bill will be brought forward during the present session of the Diet. It is proposed to reduce the number of locomotives by 40 per cent. The estimated cost of the scheme is 200,000,000 yen.—*Manchester Guardian.*

London.—Fare Revision.—The Rates Advisory Committee of the Ministry of Transport has had under consideration the following references by the Minister of Transport with regard to the revision of workmen's fares, season-ticket fares, and other fares lower than the ordinary:—

(*a*) To advise him as to the best means of revising these fares, both with respect to the rates and the times during which they are in operation, in order that the relative passenger traffic may be placed upon a paying basis, having due regard to the changes that have taken place in industrial and social conditions and in the hours of employment since workmen's fares were instituted, and to the effect of such revision upon railway, tramway, and omnibus passenger traffic (with the possibility of corresponding alterations in the fares of passengers by tramways and omnibuses) and also upon housing and labour generally.

(*b*) To review the whole question of travelling facilities by railways at rates lower than ordinary fares, and to advise what modifications, if any, should be made in these lower rates concurrently with any revision of workmen's fares.

Tube Extension.—The Ealing-Shepherd's Bush extension of the Central London Railway has now been practically completed, and trials are to be made in time for opening to passenger traffic early in August.

Manchester. — Further Wage Claim. — Manchester tramwaymen have decided to ask the National Executive of the Vehicle Workers' Union to make an immediate demand for an increase of £1 per week, and it has been suggested that the claim should be made on a district basis, with the object of grouping towns of comparable size.

Sunderland.—Strike.—The skilled men employed on the Corporation tramways at the Hylton Road car depôt recently struck because of the refusal of the Tramway Committee to concede 12 days' annual holiday with pay. There are about 30 men affected, these including electricians, engineers, joiners and painters. The matter was referred to at a meeting of the Town Council, when the chairman of the Tramways Committee defended the Committee's action, and said the men were trying to make the Council pioneers in giving the holiday. The question was a national one, and should be dealt with nationally. The skilled men's claim was one which had never been made to, much less granted by, private employers. It was true the unskilled tramway employés got an annual holiday with pay, but their case was entirely different, because they worked on Sundays and in the evenings, and it was included in their conditions of service, whereas the skilled men were engaged on general Trade Union conditions, which made no provision for a holiday with pay.

Working Costs.—Alderman G. New, chairman of the Tramways Committee, told the Town Council that the undertaking was no longer making progress, owing to rising costs. They were not going to touch fares again, and while present conditions lasted, he warned the Council it could expect no further contributions in relief of rates. The undertaking would do exceedingly well if it managed to pay its way without becoming a burden on the rates.

United States.—Chicago.—*The Times* states that the entire tramway system of Chicago was brought to a standstill on July 15th by a strike of electrical workers, acting under the influence of a Union official recently imprisoned for extortion of money.

Wallasey.—Inquiry.—An inquiry is to be held in connection with the borrowing of £3,000 for the purchase of electric vehicles for the collection of house refuse.

TELEGRAPH AND TELEPHONE NOTES.

Europe. — Intercommunication. — The League of Nations was represented, together with various specialists from different States, at the Conference which has just completed its work in Paris for the re-establishment of postal, telegraphic and wireless communication in Europe. The Council was called by the French Government on the initiative of the Communications Section of the Supreme Economic Council. A series of proposals was adopted and will be submitted to the Governments concerned, their object being to promote an improvement as rapidly as possible in areas which are outside the ordinary scope of the Postal and Telegraphic Convention, but which are at the same time vital for quick and sure communication between different countries. In order to arrange further meetings to carry out this work, the Conference decided to invite the Communication and Transit Section of the League of Nations to take charge of the arrangements for further meetings in collaboration with the postal, telegraphic, and wireless administrations of the various countries.—*Financier.*

It was announced on Wednesday that the German wireless stations were in full and unrestricted operation again.

France.—New Wireless Station.—The Lafayette wireless transmitting station, near Bordeaux, has been completed. The station, which is claimed to be twice as powerful as any other in the world, has a range of 12,500 miles; it was built by the American Army, and intended for communication with the U.S.A. At the Armistice the station was only half finished, and it was later ceded to France. There are eight antenna towers, 787 ft. high, each tower being on three feet, and weighing 550 tons. The antennæ cover an area of about a mile long by a quarter of a mile broad.

New Telegraph Charges.—The text of the new Post Office and Telegraph Bill was issued on July 14th. It proposes to legalise the increased charges foreshadowed in the Budget. Telegrams are to be 1s. for 12 words or under, and 1d. for each word over 12. An extra 6d. may be charged for telegrams on Sundays, Christmas Day, and Good Friday. Postage for newspapers is to be 1d. for the first 6 oz. and ½d. extra for each additional 6 oz.—*Morning Post.*

The Telephone Service.—New Rates.—The report of the Departmental Committee on Telephone Rates has been issued. It contains a store of information regarding telephone charges, &c., both in this country and abroad. The principal recommendations of the Committee are as follows :—

The "unlimited service" rate should be abolished. The "message rate"—*i.e.*, a fixed annual charge for the installation and a uniform charge per effective local call, is the most equitable and convenient method of charging, and should be adopted as the basis of the general tariff. The same rates should apply to business premises and private residences. A uniform charge of 1½d. per call throughout the country is recommended, the annual rental being £8 10s. in London, £8 in Birmingham, Glasgow, Liverpool, and Manchester, and £7 10s. elsewhere. The local fee should cover communication with any exchange within five miles of the originating exchange, longer distances being charged for on a uniform mileage basis. The Postmaster-General should have power to refuse service to any subscriber on whose lines the number of "engaged" calls exceeds 25 per cent. of the number of effective incoming calls, if he refuses to rent an additional circuit, and the charge for the latter should be £1 per annum less than for the original circuit. The minimum charge for calls should be discontinued. The public call office fee should be 3d. Accounts should be settled quarterly. On the foregoing basis the telephone accounts are estimated to show a surplus of £800,000 in 1921-22, of £600,000 in 1922-23, of £200,000 in 1923-24, and a deficit of £500,000 in 1924-25.

Loan.—On July 16th a White Paper was issued setting forth the total amount of loans to be authorised under the new Telegraph (Money) Bill at present before the House of Commons. The Paper says :—In accordance with the general practice of meeting capital expenditure of a reproductive nature out of loan money, provision for the development of the telephone system is made by advances of capital, which are repaid by means of terminable annuities charged upon the Post Office Vote. The last Act was passed in 1913 (Telegraph (Money) Act, 1913), and authorised the issue of capital up to £10,000,000, which is now exhausted. The present Bill authorises the Treasury to borrow a further sum of £10,000,000 for telephone development. The actual expenditure out of this sum in each year and the works to be carried out are subject to approval by the Treasury.

Sanction for the expenditure was sought in Parliament on Monday and granted. The Assistant P.M.G. said there were 200,000 unexecuted orders for telephone installations, and the P.M.G. explained that they proposed building 20 new exchanges in London, and 60 in the provinces, in addition to extending existing exchanges. Thirty-eight schemes for laying underground cables in all parts of the country were in hand ; present delays were due to overloaded junction lines, but these lines were to be increased, switchboards extended, and more operators put on, which should result in an improved service.

Wireless Telephony.— Press News.—By permission of the Postmaster-General, and with the co-operation of the Marconi Wireless Telegraph Co., Ltd., the Press Association on Monday commenced a series of experiments in the distribution of news by wireless telephone. The Chelmsford transmitting station of the Marconi Co. was used as the distributing centre. From this ordinary news services were telephoned by one of the regular telephonists of the association. The messages were received at newspaper offices in London, Burton-on-Trent, Sheffield, Newcastle-on-Tyne, Manchester, Preston, and Belfast.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review, *in which the "Official Notice" appeared.*

OPEN.

Australia.—Brisbane.—August 28th. City Electric Light Co. High-tension switchgear. Secretary, Boundary Street, Brisbane.

Melbourne.—P.M.G.'s Department. August 31st. Porous cells and outer jars for all States (schedule 1,627); bronze wire for various States (schedule 1,629); covered and braided wire for all States (schedule 1,633).

Belgium.—August 11th. The Société Nationale des Chemins de Fer Vicinaux, of Brussels (48, Rue Montoyer, Service Electriques) is inviting tenders until August 11th for the supply and laying of the armoured underground cables required (1) for the Brussels-Haecht line and (2) for the Gilly-Hansart line.

Blackpool.—August 27th. Corporation. Two water-tube boilers, superheaters, economisers, stokers, &c.; two sets of induced draught plant; coal conveying, &c., plant. (July 16th.)

Brentford.—July 27th. Board of Guardians. Electric lighting installations in the offices, infirmary, &c. (July 2nd.)

Chile.—February, 1921. The Chilean Legation at Paris (23, Avenue du Bois de Boulogne) is asking for tenders for the supply and installation of electric power in the first zone of the Chilean railways. Sealed tenders are returnable before February 1st, 1921.

France.—Competitive schemes are invited for the construction of a direct electric traction line from Grenoble to Nice through the Alps. Three premiums of 25,000, 15,000 and 10,000 fr. respectively are offered. Particulars to be seen at the Bureau du Comité d'Initiative, 29, Boulevard Dubouchage, Nice. The latest date for sending in preliminary schemes will be announced on October 31st.

Glasgow.—July 26th. Corporation. Electric lighting installation in connection with the Kennyhill and Riddrie housing scheme. Schedules, &c., from Corporation Electrical Engineer. Tenders to Town Clerk.

Grantown-on-Spey.—July 31st. Electric light work in connection with housing scheme. Specifications from Mr. H. J. Fraser, Burgh Surveyor, 25, High Street, Grantown-on-Spey.

Grimsby.—August 12th. Electricity Department. Two water-tube boilers, economisers, fittings, fans, chimneys, &c.; one 3,000-KW. high-pressure turbo-alternator and condensing plant. (July 2nd.)

Manchester. — August 6th. Electricity Committee. Water pipes and valves, &c., for Stuart Street. (July 16th.)
August 13th. Electricity Committee. One each 75-ton and 15-ton electric cranes for Barton power station. (See this issue.)

Nuneaton.—July 31st. Electricity Department. One 500-KW. rotary converter transformer and accessories. (July 2nd.)

Stalybridge.—The engineer of the Stalybridge, Mossley, Hyde and Dukinfield Electricity Board is to obtain tenders for a 6,000-KW. generating plant and auxiliary plant.

Warrington.—August 10th. Electricity and Tramways Committee. Coal elevator and conveyor. (July 9th.)

CLOSED.

Bolton.—Tramways Committee:—
Hadfields, Ltd.—Tramway points and crossings.

Carlisle.—Town Council:—
Rotary converter and switchgear.—Metropolitan-Vickers Electrical Co., £8,834.

Grantham.
Electrical installation, Westgate Hall.—J. Farr & Co., £93.

Liverpool. — Mersey Docks and Harbour Board. Accepted:—
Scottish Tube Co., four 15-ton electric cranes. [illegible]

London.—HACKNEY.—The Electricity Committee recommends the acceptance of the following tenders:—
Messrs. Babcox & Wilcox, Ltd.—Four water-tube boilers and accessories, £52,560; four induced-draught plants, complete with Davidson fans, £8,780; four economisers and accessories, £12,116.
Messrs. C. A. Parsons & Co., Ltd.—8,000-10,000-KW. turbo-alternator and exciter, £50,000.
Messrs. Hick, Hargreaves & Co., Ltd.—Complete surface condensing plant, £17,700.
Rees Roturbo Mfg. Co., Ltd.—Two motor-driven pumps for condensing plant, £6,111.
Messrs. A. Reyrolle & Co.—E.H.T. switchgear, £18,274.

Richmond-on-Thames.—Town Council:—
Fire alarm installation.—Beard & Co., £2,160.

Sunderland. — Town Council Electricity Committee. Accepted:—
Pirelli-General Cable Works, Ltd.—L.T. single-core cable.
Ferguson, Pallin & Co., Ltd.—Switchgear.
New Switchgear Construction Co., Ltd.—Switchgear.
Parmiter, Hope & Sugden.—Distribution board.
H. G. Jordan. C.I. joint boxes.
W. G. Farrow & Co.—C I. joint boxes.
R. Farrow & Co.—Preservative compound.

NOTES.

U.S.A. Water-Power Legislation.—Contrary to expectation, the Water-Power Bill which has been before the United States Congress for the last eight years, in one form or another, has at last been finally enacted; the signature of the President had been withheld when Congress adjourned, and it was supposed that the measure was thereby automatically cancelled. However, the Attorney-General ruled that if the President signed the Bill within the statutory 10-day period, the Bill would become law, and the signature was duly affixed to the Bill. American engineers are jubilant; applications for licences relating to more than 500,000 H.P. had already been lodged by the end of last month. The next most important step is the organisation of the Federal Power Commission, which will have wide powers to facilitate the development of water-power on a vast scale throughout the United States.

Electricians' Strike.—The electricians employed at the Penistone works of Messrs. Cammell, Laird & Co., have been on strike for about three weeks on account of the refusal of a foreman to join the E.T.U. They, alternatively, demand his dismissal, but Messrs. Cammell, Laird have decided to retain his services.

The Electricity Supply Commercial Association.—At a recent meeting at Newcastle, the general secretary, Mr. G. R. Smith, stated that the membership was nearly 3,000, the result of two years' efforts.

Damming the Severn.—The Great Western Railway Co. is ready to proceed with the scheme for bridging and barring the River Severn at Beachley, at a cost provisionally estimated at between six and seven millions. The matter now awaits the verdict of the Ministry of Transport's experts, who have been engaged upon it for some time.

Appointments Vacant.—A Grade III lectureship in electrical engineering is vacant (£300) at the University of Liverpool; shift engineer for Carlisle; assistant lecturer and demonstrator in electrical engineering for Sheffield University (£350); assistant lecturer in electrical engineering for Newcastle-upon-Tyne Education Committee (£300 to £450); visiting teacher (evening) of electrical engineering for L.C.C. Engineering School at Poplar; shift engineer for Wakefield; teacher of electrical engineering for Rugby Technical School (£300 to £450); instructor in electrical engineering for evening classes at Kingston-on-Thames Technical Institute. See our advertisement pages to-day.

Educational. — FINSBURY TECHNICAL COLLEGE. — We learn with regret that the future of this famous institution, from which have come so many of our best engineers and chemists, is in the balance. In 1919, three times as many candidates sought admission as could be accommodated; but great difficulties have been experienced, due to the shortage of equipment and staff—the latter, as we recently pointed out, being attracted from all technical colleges into industrial life by the vastly better prospects which it offers. The college will be carried on for a year as at present, but after that its continued existence is uncertain.

IMPERIAL COLLEGE OF SCIENCE.—The Finance Committee of the L.C.C. states that, since the Council decided in 1903 to limit to £20,000 its annual grant to the governors of the Imperial College of Science and Technology, the circumstances of the college have materially altered. The expenditure of the governors has risen from £30,816 in 1907-8 to £106,532 in 1918-19, the Council's grants in the meantime having advanced from £5,000 to £14,000 (including technical optics). The number of students in attendance (1,045) is now more than in any previous year. If the Council's assistance is to have the same relative value as before the war, it is clear that its grant will have to be increased. The Government has recognised the urgent needs of the college by increasing its grant from £32,000 to £55,000, and the Finance Committee acquiesces in the proposal that the Council's grant shall be increased on the agreed basis of 1 : 3 of the increased Government grant, notwithstanding that the limit of £20,000 fixed in 1903 will thereby be exceeded. If this is agreed to, the Council will be contributing, apart from its contributions in respect of the technical optics department, £20,700 a year, as against £55,000 from the Government, *i.e.*, in the proportion of 1 : 2·75. This is slightly in excess of the agreed basis of 1 : 3, but as the total grant of £20,700 includes the grant of £13,000 made on the former basis of 1 : 2, it has been agreed to.

GIFTS TO UNIVERSITIES.—Sir Jesse Boot has given £50,000 to the new Nottingham University scheme—£30,000 for building and £20,000 for a Chair of Chemistry. A gift of £15,000 has been made to Liverpool University by Alderman Louis Samuel Cohen, of Messrs. Lewis, Ltd., the Liverpool store proprietors.—*The Times.*

British Engineering Standards Association (Inc.).—The Association held its second annual meeting on July 15th, at the Institution of Civil Engineers, when the chairman, Sir Archibald Denny, Bart., presented the report and reviewed the position, dwelling with especial emphasis on the need for further financial support. He said the Association was rendering an indispensable service to British trade at home in co-ordinating standards, promoting efficiency, and eliminating waste, and was also doing much to push British trade abroad. It was, therefore, regrettable that even after 20 years of useful work, the engineering industry of the country was only now slowly putting the Association in a position adequately to cope with the increasing demands made upon its organisation. There were some 300 Committees, manned by over 1,400 members, who gave their time and experience often at great personal expense and inconvenience to this great national work, and the country as a whole, as well as the industry, owed a debt of gratitude to these public-spirited gentlemen for their loyal service, and also the engineering firms which allowed their engineers, managers, and others to take part in the work.

Since the last annual meeting 27 British Standard Specifications had been issued, and some 70 were under revision, the most important of which, the steel sections for general building construction, including shipbuilding, had just been completed.

The engineering public was making increased use of the British Standard Specifications. The chairman stated that 31,000 of the specifications had been sold, almost all in this country, against about 3,000 in pre-war years. The accounts for the year were adopted, and Messrs. Deloitte, Plender, Griffiths & Co., were re-elected as auditors.

The Training of Apprentices.—The Bradford Technical College proposes to institute a new course for the training of engineering apprentices in September. The course will extend over one day per week for the year, and will cover the subjects usually taught in three years' evening class work with an attendance of three nights per week. The employers in the engineering trade of the city are to allow their smartest apprentices off from work to enable them to take the course. It is stated that there will be accommodation for about 50 apprentices.

Association of Mining Electrical Engineers. — On Saturday, July 10th, the Midland and Yorkshire branches of the Association paid a visit to the Neepsend power station of the Sheffield Corporation, and were greatly interested in this up-to-date plant.

Service Notes.—The Admiralty announce that a special supernumerary list of Royal Marine officers has been instituted for those officers of the Marines at present employed on wireless duties who may desire to continue on those duties for the remainder of their careers. The list will be known as the "Supernumerary List, R.M. (W/T)."

Officers who have completed five years' continuous W/T duties by January 1st, 1921, are to have the option of being transferred to this list or returning to corps duty. The option is to be exercised not later than September 1st.—*The Times.*

The question of transferring the maintenance of electrical machinery of warships from the torpedo to the engineering department of the Royal Navy is now under consideration by the Admiralty.

The Fuel Position.—The Fuel Research Board in a recent report states that the estimated petrol requirements of this country for the present year amount to 250,000,000 gallons, and the possibilities of other fuels for traction have been fully investigated. It has been concluded that the production of power alcohol from potatoes, barley, &c., is not economically possible in this country. The production of benzol from coke ovens and gasworks in this country during 1919 was 20,000,000 gallons, and it is not anticipated that this figure will be improved upon to any great extent during the present period. It is suggested that town and coke-oven gas might be extensively used for omnibuses and passenger traffic generally, safe containers could be constructed, and charging stations established on all principal routes.

Russian Water Power.—The *Economic Review* quotes from an article in the Norwegian *Social-Demokraten* referring to the great untapped natural resources of North Russia. It is remarked that the North Russian waterfalls have not been utilised to any extent, mainly owing to lack of systematic legislation. They are situated chiefly in the provinces of Olonetz and Pomor, in the course of the rivers Kivats, Girvas, and Por-Porog. The coal shortage frequently makes itself acutely felt in Russia, and the mines in the Donetz region are by no means so inexhaustible as used to be assumed. It is, therefore highly probable that the North Russian water-power will play an important part in the subsequent electrification of the North and Central Russian railways.

The Physics and Chemistry of Colloids and their Bearing on Industrial Questions.—The Faraday Society and the Physical Society of London are arranging to have a joint symposium and general discussion on this important subject next October. The subject will be introduced by a brief survey of the present position of colloidal physics and chemistry, and discussion will then follow on the following subdivisions of the subject: Emulsions and Emulsification; Physical Properties of Elastic Gels; Cataphoresis and Electro-endosmose; Precipitation in Disperse Systems; Glass and Pyrosols; Non-aqueous Systems.

In spite of the importance of colloidal physics and chemistry in many branches of manufacture and of the interest which the subject has aroused in recent years, much light remains to be thrown on the nature of the manufacturing processes in which colloids play a part. It is hoped that the discussion will focus attention on some of these problems, and that its result will be to indicate lines of advance and suggest further researches, and that it will be fruitful not only in helping to a fuller understanding of the laws of the colloidal state, but also in suggesting new applications for colloids in the laboratory and in the works.

The exact date and place of meeting, and further particulars will be announced later. In the meantime anyone desirous of using the opportunity of the discussion to bring forward experimental matter or theoretical considerations bearing on the above-mentioned branches of the subject is asked to communicate as soon as possible with the secretary of the Joint Committee, Mr. F. S. Spiers, 10, Essex Street, London, W.C. 2.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

MR. W. MCKILLOP, chief engineer of the Midland Railway Hotels Department, entertained at dinner the members of the staffs of Liverpool and Manchester, on July 15th, the occasion marking his departure for London on other important duties. Mr. McKillop has been with the Midland Railway Co. 20 years. In 1918 he was called to prepare and arrange the electrical plant in the five Midland Hotels, for the members of the Peace Conference. Before taking up his position with the Midland Railway Co., he was a sea-going engineer. His colleagues took the opportunity of presenting him with a gold watch. Mr. F. C. Makeham presided, and made the presentation on behalf of the staffs.

The Sunderland Town Council, after a long discussion, adopted the recommendation of the Electricity Committee to increase the salary of the electrical engineer and general manager, MR. A. S. BLACKMAN, from £1,200 to £1,500 per annum. The voting was 30 for, 11 against, with one neutral. The terms of Mr. Blackman's appointment were varied so that three months' notice instead of six months' notice may be given on either side. Many complimentary things were said regarding Mr. Blackman's work, and his high ability both as an engineer and a commercial manager.

The Times states that MR. ALAN A. CAMPBELL SWINTON, F.R.S., has been elected chairman of the Council of the Royal Society of Arts.

The Carlisle Town Council has increased the salary of MR. SALT, electrical engineer, to £885 per annum, rising to £1,000 on April 1st next, the latter sum to include remuneration in respect of all additional duties imposed upon him as engineer for the proposed extensions.

The Manchester *Daily Dispatch* reports that two members of the Manchester University staff have received appointments at Swansea University College. DR. EDWARDS, Professor of Metallurgy at Manchester University, has been appointed to a similar position at Swansea at £1,250 per annum. DR. EVANS, Lecturer in Physics at Manchester University, has been appointed Professor of Physics at Swansea at £800 per annum.

MR. MAXWELL GARNETT has resigned the office of Principal of the Manchester School of Technology. A Press report states that he has accepted the appointment of general secretary to the League of Nations Union.

CAPT. F. RISCH (late R.E.) has resigned the position of special representative that he has held with the Edison Swan Electric Co., Ltd., since his demobilisation last year.

CAPTAIN E. I. BAX is to succeed the late Right Hon. Lord Downham as chairman of the Westminster Electric Supply Corporation, Ltd.

LIEUT.-COLONEL GEO. G. EWER, D.S.O., A.M.I.E.E., has now resumed his duties as sales engineer to the Metropolitan Borough of Stepney Electricity Supply Department, after an absence of almost six years on active service—five of which have been spent abroad in Gallipoli, Egypt, Palestine, and Syria.

MR. LASCELLES PARRINGTON, A.M.I.E.E., of Collins Street, Melbourne, who is Australian representative of the Electric Construction Co., Ltd., is at present in this country arranging for representation out there on behalf of additional British electrical and general engineering firms who are anxious to begin operations in the Australasian market. Communications may be addressed to him, care of the Electric Construction Co., Ltd., at Dashwood House, London, E.C.

Captain JOHN MUIR DONALDSON, M.C., M.I.E.E., has been appointed engineer-in-chief to the North Metropolitan Electric Power Supply Co., in succession to Mr. E. T. Ruthven-Murray, who has accepted another appointment with the company.

Obituary.—MR. JAMES WEIR.—We regret to learn of the death of Mr. James Weir, who, in conjunction with his brother, founded the firm of G. & J. Weir, of Glasgow, from which business he retired many years ago.

LEGAL.

BRITISH THOMSON-HOUSTON APPEAL.

IN the Court of Appeal, before the Master of the Rolls and Lords Justices Warrington and Younger, on July 13th, the case of the British Thomson-Houston Co., Ltd., *v.* The Corona Lamp Works, Ltd., was heard upon the appeal of the plaintiffs from the judgment of Mr. Justice Sargant in the Chancery Division.

The action was brought to restrain an alleged infringement of the plaintiffs' letters patent granted in 1913 for improvements in incandescent electric lamps, known as the half-watt lamps.

Mr. COLEFAX, K.C., in support of the appeal, said Mr. Justice Sargant had decided the issue of infringement in favour of the plaintiffs and upon the issue of validity his Lordship had found that the invention was novel and good subject matter as an invention of a high order of merit and of undoubted utility. It was also admitted that the specification was sufficient to enable anyone to whom it was addressed to put the invention into practice. It was also admitted that the specification was framed *bona-fide*, and without ambiguity. Mr. Justice Sargant had dismissed the action solely on the ground that the specification did not sufficiently describe the actual ambit of the monopoly claimed. He (counsel) contended that the judge had looked at the invention from a wrong standpoint, and that the plaintiffs were entitled to succeed as they had given to the world a lamp of remarkable efficiency. Hearing adjourned.

Mr. KERLY, K.C., on behalf of the respondents, in support of the judgment of Mr. Justice Sargant, contended that if the plaintiffs' specification was looked at carefully, all it came to was that one got better results in a big lamp than in a little lamp; that was the whole story of the patent, and unless the plaintiffs could make out that "large" meant something they must fail. In the defendants' view it was quite possible to take a filament which nobody would call large and run that so as to get a valuable light.

Mr. COLEFAX replied on behalf of the appellants, and on the conclusion of the arguments, their Lordships reserved judgment.

NEW COMPANIES REGISTERED.

Mountrath Electricity Supply Co., Ltd. (5,024).—Registered in Dublin July 6th. Capital, £6,000 in £1 shares. To carry on the business indicated by the title. The subscribers are: H Franks, J.P., Woodbrook, Mountrath, estate agent (50); Dr. T. J. Nunan, Main Street, Mountrath (60); J. Miller, Main Street, Mountrath, victualler (100); F. Wallis, J.P., Main Street, Mountrath (250); P. J. Delaney, Main Street, Mountrath, wine merchant (100); E. Gallagher, Main Street, Mountrath, wine merchant (100); P. Sheeran, Main Street, Mountrath, draper (50); T. Moloney, Market Square, Mountrath, draper (100). The first directors are not named. Secretary: T. Moloney. Registered office: Market Square, Mountrath.

Wilson Lighting Co., Ltd. (168,917).—Private company. Registered July 5th. Capital, £1,000 in £1 shares. To carry on the business of manufacturers of and dealers in mantles, burners, and all accessories for gas and electric lighting. The first directors are: Mrs. L. F. Wilson, 57, Summerfield Crescent, Birmingham; H. M. Wilson, 57, Summerfield Crescent, Birmingham. Registered office: 57, Summerfield Crescent, Birmingham.

Bankside Finance and Industries, Ltd. (168,918).—Private company. Registered July 9th. Capital, £250,000 in £1 shares. To carry on the business indicated by the title and that of dealers in and managers of lands, buildings, and hereditaments, constructors of electric power stations, cold air stores, warehouses and shops, builders, builders' merchants, contractors, timber merchants, engineers, electricians, restaurant and hotel proprietors, repairers of ships, barges, lighters, boats, and other vessels, dealers in wagons, horses, motor vehicles, engines and tractors, &c. The subscribers (each with one share) are: J. B. Braithwaite, The Highlands, New Barnet, stock and share broker; J. C. Bull, Edenholme, Stevenage, Herts, director. The first directors are to be appointed by the subscribers. Solicitor: W. Morris, 17, Throgmorton Avenue, E.C.

Stella Lights, Ltd. (168,912).—Private company. Registered July 9th. Capital, £100 in 1s. shares. To sell the goods of the Stella Lamp Co., Ltd. The first directors are: G. W. P. Goodchild (permanent governing director and chairman), 23, Randolph Crescent, Maida Vale, W.; C. H. Sowerby, 58, Maldon Road, Acton, W.; M. H. Copeland, 20, St. James's Mansions, Muswell Hill, N. Secretary: E. W. Mayhew. Registered office: 17, Featherstone Buildings, Holborn, W.C.

Centropolis Public Works Co., Ltd. (169,015).—Private company. Registered July 14th. Capital, £50,000 in £1 shares. To carry on the business indicated by the title. The first directors are: Comdr. Sir Arthur T. Dawson, Bt., R.N., 6, Great Stanhope Street, W. (director, Wm. Beardmore & Co., Ltd., &c.); Sir Thomas G. O. Thurston, K.B.E., 26, Courtfield Gardens, South Kensington, S.W.5 (Vickers, Ltd., &c.); Lieut.-Col. W. C. Symon, 52, Hans Mansions, S.W.3 (Vickers, Ltd., &c.); G. P. Walford, 50, Courtfield Gardens, South Kensington, S.W.5 (director Ferro Concrete Ship Construction Co., Ltd.); L. H. G. Walford, Chessington Place, Esher, Surrey (Anglo-Polish Steamship Line, Ltd.). Secretary: C. Nevinson. Solicitor: S. H. Hargrove, 10, Victoria Street, S.W. Registered office: Vickers House, Broadway, Westminster.

Vulcan Arc Welding and Transport Co., Ltd. (169,005).—Private company. Registered July 13th. Capital, £10,000 in 1,000 founders' and 8,000 ordinary shares of £1 each, and 2,000 employés' shares of 1s. each. To carry on the business indicated by the title. The subscribers (each with one share) are: J. Jones, 83, Guther Street, Everton, Liverpool, motor mechanic; T. A. Gillam, 13, Markfield Road, Bootle, Liverpool, electric welder. The subscribers are to appoint the first directors. T. A. Morris signs as "director." Registered office: 2-4, Harrington Street, Liverpool.

Rickard, Wright & Dean, Ltd. (169,029).—Private company. Registered July 14th. Capital, £4,500 in 4,000 10 per cent. cumulative preference shares of £1 each, and 10,000 ordinary shares of 1s. each. To carry on the business of electricians, electrical and mechanical engineers, founders, smiths, machinists, manufacturers of and dealers in electrical wires, cables, and flexible cords, &c. The first directors are: E. Rickard, 5, Duckworth Terrace, Bradford; W. H. Dean, 361, Lytham Road, Blackpool; A. Wright, 11, Fernbank Road, Undercliffe, Bradford. Registered office: 17, Neal Street, Bradford.

Thames Valley Traction Co., Ltd. (168,948).—Registered July 10th. Capital, £75,000 in £1 shares. To take over the business carried on in Berkshire and neighbouring counties by the British Automobile Traction Co., Ltd. The first directors are: S. E. Garcke, Wye Lodge, Belmont, Maidenhead, director British Automobile Traction Co., Ltd.; L. M. Myers, 2, North Gate, Regent's Park, N.W. 8, director, British Automobile Traction Co., Ltd.; W. Wolsey, Everley, Wickham Way, Parklangley, Beckenham, director, Thomas Tilling, Ltd. Minimum cash subscription, 7 shares. Registered office: Bridge Street, Maidenhead.

Kable Electrical Co., Ltd. (168,906).—Private company. Registered July 9th. Capital, £2,000 in 1,000 10 per cent. cumulative preference shares of £1 each, and 2,000 ordinary shares of 10s. each. To take over the business carried on by F. N. Kennett at 41, Jermyn Street, St. James's, S.W. 1, as the "Kable Electrical Co." The subscribers (each with one share) are: F. N. Kennett, 41, Jermyn Street, St. James's, S.W. 1, engineer; S. A. Curzon, 41, Jermyn Street, St. James's, S.W. 1, engineer. F. N. Kennett is permanent governing director. Registered office: 41, Jermyn Street, S.W. 1.

British Electrical Winders, Ltd. (168,953).—Private company. Registered July 12th. Capital, £1,000 in £1 shares. To take over the business of an electrical and mechanical engineer carried on by W. A. Hymas at 17, London Road, Newbury, Berks, together with the rights connected with an invention for an ever-ready watch key and mechanical cycle horn designed by him. The first directors are: Walter Alfred Hymas, 17, London Road, Newbury, Berks.; Walter Albert Hymas, 27, Lower Anchor Street, Chelmsford. Registered office: 17, London Road, Newbury, Berks.

Magnesium Co., Ltd. (168,971).—Private company. Registered July 12th. Capital, £75,000 in £1 shares (60,000 "A" and 15,000 "B"). To carry on the business of chemical manufacturers, metallurgical, manufacturing, and consulting chemists, manufacturers of magnesium and its alloys, magnesium and alkali chlorates, and metal salts of all kinds, ore smelters, metal manufacturers and workers, &c., and to adopt an agreement with the Magnesium Metal Co., Ltd., the Magnesium Chloride Co., Ltd., Electro-Chemical Development Co., Ltd., and E. A. Ashcroft. The subscribers (each with one ordinary share) are: G. Reader, 35, Coleman Street, E.C.2, solicitor; W. A. Chadwick, 35, Coleman Street, E.C. 2. The first directors are: P. St. Clair Matthey, R. P. Sellon, E. Caillard, A. H. Barker, and E. A. Ashcroft. The first four named are nominees of the Magnesium Metal Co., Ltd. The said company and E. A. Ashcroft have power to appoint other directors. Solicitors: Geo. Reader & Co., 35, Coleman Street, E.C.

Hough Electric Motor Co., Ltd. (168,963).—Private company. Registered July 12th. Capital, £2,000 in £1 shares. To carry on the business of electrical engineers, dynamo and electric motor makers, electricians, &c. The first directors are: J. E. Hough, 12, Greenhill Avenue, Rochdale; J. K. Cotton, 309, Oldham Road, Rochdale; R. Ramsden, 29, Daresbury Street, Cheetham Hill, Manchester. Solicitor: S. Turner, Layland Chambers, Rochdale.

F. A. Norris and Dutton, Ltd. (168,936).—Private company. Registered July 10th. Capital, £40,000 in £1 shares (20,000 preference). To carry on the business of mechanical, heating, ventilating, lighting, and power plant engineers, &c. The first directors are: F. A. Norris (chairman and permanent controlling director), West View, Red Post Hill, Dulwich, S.E. 21; and H. W. Dutton, 61, Goldhurst Terrace, Hampstead, N.W. 6. Registered office: 11-12, St. Andrew's Hill, E.C. 4.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Lithanode, Ltd.—F. A. Bell, of Billiter House, Billiter Street, E.C., as receiver on June 28th, 1920, under powers contained in instrument dated December 18th, 1919.

Riglite Manufacturing Co., Ltd.—Particulars of £1,000 debentures authorised June 18th, 1920, whole amount issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

T. and J. Jackson, Ltd.—J. Bracher, of 134, Hindes Road, Harrow, as receiver or manager on June 19th, 1920, under powers contained in debentures dated July 9th, 1918.

Tranmere Engineering Co., Ltd.—Satisfaction in full on July 8th, of mortgage dated January 31st, 1920, securing £600.

Merthyr Electric Traction and Lighting Co., Ltd. (57,908).—Return dated May 11th, 1920. Capital, £100,000 in £5 shares (6,000 preferred and 14,000 ordinary), 6,000 preferred and 8,000 ordinary taken up. £70,000 paid. Mortgages and charges £48,400.

W. Lucy & Co., Ltd. (51,908).—Return dated April 2nd, 1920. Capital, £15,000 in £10 shares (250 preferred and 1,250 ordinary), 250 preferred and 1,080 ordinary taken up. £10,810 paid. £2,490 considered as paid. Mortgages and charges £550.

Mirrlees, Bickerton & Day, Ltd.—Return dated June 18th, 1920. Capital, £350,000 in £1 shares (250,000 ordinary and 100,000 5½ per cent. cumulative preferred), 249,430 ordinary and 50,000 preferred shares taken up. £280,830 paid on 230,930 ordinary and 50,000 preferred, leaving £91 in arrears. £18,500 ordinary shares considered as fully paid. Mortgages and charges £21,111 14s. 11d.

Woodbridge & District Electric Light Co., Ltd.—Issue on June 25th, 1920, of £7,420 debentures, part of a series already registered.

Anglo-American Telegraph Co., Ltd. (2,891C).—Return dated June 18th, 1920. Capital, stock £7,000,000 and £376,340 ordinary stock, £3,311,830 preferred ordinary stock and £3,311,830 deferred ordinary stock. All stock taken up. £600,000 paid. £6,400,000 considered as paid. Mortgages and charges nil.

Bastian Meter Co., Ltd. (53,304).—Return dated May 6th, 1920. Capital, £20,235 10s. in 68,942 ordinary shares of 5s. each and 3,000 preferred shares of £1 each. 2,011 preferred and 39,672 ordinary taken up. £3,082 10s. paid, including £3 10s. paid on shares forfeited. Mortgages and charges nil.

West Coast of America Telegraph Co., Ltd.—Return dated June 1st, 1920. Capital, £232,530 in 53,008 ordinary shares of £2 10s. each, and 100,000 preferred shares of £1 each. 45,008 ordinary and 100,000 preferred shares taken up. £100,020 paid on 8 ordinary and 100,000 preferred. £112,500 considered as paid on 45,000 ordinary. Mortgages and charges nil.

West India & Panama Telegraph Co., Ltd. (11,116).—Return dated June 9th, 1920. Capital, £2,445,630 in £10 shares (34,563 first preferred, 10,000 second preferred, and 200,000 ordinary). 34,563 first preferred, 4,669 second preferred, and 88,321 ordinary taken up. £1,275,530 considered as paid. Mortgages and charges £79,600.

CITY NOTES.

Edmundsons' Electricity Corporation, Ltd.

The annual meeting was held on July 15th, at Winchester House, E.C. Mr. P. D. Tuckett, who presided, referred to the Bill which the company introduced into Parliament last autumn for regulating their charges in accordance with their needs. He said that it provided for increase of their maximum rates to 1s. 2d. per unit, with a sliding scale regulating the return on capital in accordance with the rate charged. They believed that tariff would have proved to be an entirely equitable one. All their costs had long since doubled, and were now all but trebled; their coal and wages bills alone having increased by £65,000 last year, following on an increase of nearly £50,000 the previous year, whilst for the current year they were already faced with an additional burden of £80,000 on those two items, bringing the total increase since 1914 up to over £250,000 per annum, quite apart from the heavy increase in rates, taxes, repairs, and all the other items of cost. Those figures were exclusive of the Lancashire Power Co., and represented merely the increased price per ton and the increased rate of wage per man, and not the total increases due to increased output. Yet, in face of such increases, 10d. a unit was the highest figure to which they had been allowed to raise their rates, and that only recently, and in a few instances, whilst in some of their undertakings they were still limited to 7d. Most of the London companies, and many of the large provincial undertakings had found it necessary to double their pre-war rates of charge, and were now charging 8d., although with their far richer and more densely populated areas, their large generating sets, and their infinitely larger outputs, they were in an incomparably better position to meet the present adverse conditions. Apart from summer time, the 48-hour week, and early shop closing, all legislative enactments which had seriously impaired the earning power of the business, they, like everyone else, were mainly suffering from the diminished purchasing power of a depreciated currency. It was with regret that he had to report the rejection of their Bill. At the same time it had undoubtedly served a useful purpose in bringing home to the authorities the urgency of their needs, and he believed the Electricity Commissioners were now taking steps to enlarge their powers, so as to be able to grant them more adequate relief. In the meantime they had been notified of their readiness to grant them immediate further relief within the

limit of their existing powers, and they had accordingly lodged applications which he hoped would enable them to charge substantially higher prices in almost all cases as from the commencement of the current quarter. Proceeding to deal with the accounts, the chairman stated that with the approval of the Debenture Stockholders' Committee they had arranged to issue at a net price of about 94, £75,000 6½ per cent. notes, redeemable at par on February 1st, 1923, to meet their pressing capital requirements. Under the difficult circumstances of the times they could not have expected to make a more satisfactory arrangement, however unsatisfactory it might be for them to have been compelled to resort to so extreme and costly an expedient. They had, however, no intention of succumbing without a vigorous struggle to the short-sighted and grossly unfair treatment to which they had been subjected during the past two years, and he hoped it might not be very long before they saw a marked change for the better. In the meantime the paralysing depletion of their resources, at the critical period when every encouragement should have been afforded them to make good their war-time losses, and provide for the needs of the future, would inevitably compel them to restrict their commitments within the narrowest limits, thereby preventing their taking advantage of developments which might otherwise have been open to them. Now that the Electricity Commissioners had been appointed to advise the Government and Parliament, he sincerely trusted they might look forward to a more enlightened and generous treatment. The gross profit was reduced by £2,773, and the net profit by £5,536. Owing to the completion of the large Government orders on which they were engaged in 1918, the gross trading profit showed a drop of £1,300, but at £9,962 it still remained quite a satisfactory figure. The net result of the year's operations was that they had a balance of £8,099, making, with the balance of £6,765 brought forward, an available total of £14,865, of which they recommended that £4,775 should be applied in writing off the discount and issue expenses of the three-year note issue, leaving £10,090 to be carried forward. It was deplorable that they should be obliged to withhold payment of the preference dividend when with any semblance of fair treatment they ought to have been paying an ordinary dividend. In 1913 and 1914 their net profits available for dividend exceeded £23,000, having shown steady expansion year by year down to that date, yet with their connections more than doubled they were now worse off than in 1909. During the war they were able and were content to bear their share of the common sacrifice, but that they should now be deliberately deprived of all return on their capital, and almost the means of carrying on their business, was flagrantly unjust, and they had every right to feel aggrieved at the callous indifference to their sufferings which had brought them to such a pass. As he had already said, he hoped, the relief for which they had been so long clamouring would shortly be forthcoming, and that they would then be able to go forward once again with the expectation of earning a reasonable return on their capital, for, unless they could, it was obvious that no further capital would be forthcoming for the development of the business. In the critical and anxious position in which they now stood, and in the present uncertainty as to the treatment which they were to receive, he hesitated to offer them any advice as to the value of their shares, but he thought it would be a pity if they were to allow the natural disappointment and discouragement of the moment to induce them lightly to throw away their holdings. The enormous increase in the cost of plant and buildings had greatly enhanced the value of the property, and it was only the artificial and unfair restriction of their rates of charge that prevented its producing a satisfactory return. Provided, therefore, they were given the right to charge prices commensurate with the increased costs to which they were now subjected, he saw no reason why they should look forward to the future with any less confidence than formerly.

British Thomson-Houston Co., Ltd.

We were only able to refer briefly to the report of this company in our last issue. The directors state that the buildings and machinery of the company at Rugby, Coventry, and Willesden were maintained in good condition throughout the year. At Rugby a number of extensions were begun, but their completion has been delayed by the various causes which have interfered with building operations generally. At Willesden a new building is practically completed, which will considerably increase the manufacturing facilities. During the year 1919, the company contracted to purchase a property at Blackheath, near Birmingham, which will hereafter be known as the company's "Birmingham Works." It was not until early in June this year that questions relating to titles were finally arranged. The company has now obtained possession, and the necessary steps are being taken to make it available for manufacturing purposes. The property consists of about 70 acres, on which are several very suitable buildings with an aggregate floor area of about 250,000 sq. ft. Plans are in hand for the erection of further buildings on this site. The profits for the year, after deducting all expenses and charges other than interest on debentures and loans, and after making provision for estimated war taxation for the year, were £412,400, plus £150,863 brought forward, making £563,263. Of this, interest on debentures and loans absorb £134,230, and there is to be appropriated for depreciations, reserves, and adjustments, £220,602, leaving £208,431 to be carried forward. The capital reserve account has been increased from £245,555 to £251,772. The directors recommend that dividends be declared payable out of this reserve, free of further income tax, as follows: In full payment of the accumulated dividends on the preference shares, £210,000 (being £5 5s. per £10 share), and to the ordinary shareholders, £40,000 (being £1 per £10 share). It is proposed to capitalise this £250,000 and to issue fully-paid ordinary shares to that amount to the shareholders. It is proposed to increase the share capital of the company to £4,000,000, of which £2,000,000 will be ordinary shares and £2,000,000 preference shares, both of the denomination of £1 each, and the necessary meetings have been called to effect this object. Of the 2,000,000 ordinary shares, 400,000 will replace 40,000 ordinary shares now outstanding of the par value of £10 each; 400,000 will replace 40,000 outstanding preference shares of the par value of £10 each; 250,000 will be distributed in respect of the capital reserve account, as stated above. The balance will be issued as may be required. The preference shares will be entitled to cumulative dividends at the rate of 7 per cent. per annum. The total par value of debentures redeemed to date is £54,405, which leaves a net amount outstanding at July 1st of £157,595. The amount outstanding at December 31st, 1919, was £162,895. By a contract recently concluded with the International General Electric Co., Inc., which contract took the place of one previously existing between this company and the General Electric Co., of New York, the territorial and patent rights of the company have been extended and for a long period of years. Much closer relationships have also been established between this company and its sister company in France—the Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston, by acquiring a number of shares of that company. We have also acquired an interest in the Société d'Electricité et de Mécanique (Procédés Thomson-Houston & Carels) of Belgium. Several of the directors of this company are also on the boards of these French and Belgian companies. The directors have followed their usual practice of making reserves to cover risks in connection with bad debts and other contingencies.

Bombay Electric Supply & Tramways Co., Ltd.

A scheme of arrangement by the Bombay Electric Supply and Tramways Co., Ltd., was sanctioned by Mr. Justice Astbury in the Chancery Division on Tuesday. Mr. Clanson, K.C., said although the scheme involved very large sums, it was of the simplest possible character. The company was a very old established one. It was incorporated in England to run a tramway undertaking in Bombay. For economic reasons—excess profits and double income tax probably had not a little to do with it—it was obviously to everybody's benefit that the company should cease to be incorporated in England and become an Indian incorporated company, and the real point of the scheme was that in respect of each preference share of £10 in the company three preference shares for 50 rupees in the Indian company should be issued, and in respect of each ordinary share of £10, 5 of 50 rupees should be issued. Nine-tenths of the shareholders were in Bombay, and meetings were held there and supplemental meetings in England, the minutes of which were telegraphed to Bombay and incorporated in the Bombay minutes, and proxies were deposited in England so as to enable English shareholders to vote at the Indian meetings. Counsel added that all the meetings in England and Bombay in connection with the scheme had been unanimous.

His LORDSHIP: They always are if they wish to escape taxation.

Ward and Goldstone, Ltd.

For the year ended March 31st (only the latter half of which period was under the new company's working) the directors report that the net profit, after providing for bad and doubtful debts, depreciation, salaries, commissions, directors' fees, advertising, and all other charges, excepting income tax and excess profits duty, amounts to £33,147. Out of this has been paid to vendors, being proportion of profits to date of formation, £11,325; dividend of 7 per cent. on the cumulative preference shares for the half-year ending March 31st, and discount on shares amounting (less income tax) to £1,969; 7 per cent. on the ordinary shares for the half-year amounting (less income tax) to £1,348; income tax, £1,827; leaving a balance (subject to excess profits duty) of £16,678. It is proposed to pay a further 4 per cent. on the ordinary shares, making 11 per cent. in all for the half-year, amounting (less income tax) to £770, to pay a participating dividend of 1 per cent. on the cumulative preference shares (payable with the September interim dividend), making 8 per cent. for the half-year, amounting (less income tax) to £280, and to carry forward to next account, subject to excess profits duty, £15,627. "Though it is not possible to state the amount to be paid for excess profits duty, the directors are satisfied that there will be a very substantial sum carried forward after payment of this duty. The profit for the year under review, due to the increased turnover, substantially exceeds that of previous years. The moulders', railway, and other strikes rendered it impossible to remove to the new works during last year; good progress, however, is now being made in the new premises, where a number of Departments are running satisfactorily. It is anticipated that the removal

will be complete by the end of the year. The demand for our manufactures and supplies continues to be sustained, and the works have booked a record volume of business ahead. In order to ensure regular supplies of the internal combustion engines sold with our well-known 'Mercure' electric lighting plants, a controlling interest has been taken in the company manufacturing these engines, which interest, we believe, apart from the value of obtaining preferential deliveries and terms, should provide satisfactory dividends. The unfair incidence of the increased excess profits duty, and the desirability of retaining resources for the financing of the enlarged volume of business offered, compel for the present the necessity of a conservative division of profits in the form of dividends."

Fuller's United Electric Works, Ltd.

Mr. George Fuller, M.I.E.E., presiding at the first annual meeting, on July 14th, at Chadwell Heath, said that the results had fully justified the union of the four companies. Some of the difficulties of the year had checked their progress somewhat, but the work had been highly satisfactory and full of interest. The Ilford Corporation had not been able to supply them with sufficient power to keep their machinery going at full pressure, but that difficulty was being rapidly overcome. The moulders' strike had held up the delivery of their new machinery, and the difficulty in obtaining raw material had prevented the completion of the new buildings, until a quite recent date. Such circumstances had prevented full use being made of the extra capital received at the formation of the company. The year had been largely a transition period, so that it had not been easy to earn large profits. After referring to the financial results of the year and the dividends (see ELEC. REV., July 16th), the chairman referred to the activities of various departments of the business. In the primary battery department they had acquired during the year a very valuable process; they had designed some batteries for wireless sets which they believed would be extensively used. Their production of wires and cables had made rapid progress; the trade grew faster than they could keep pace with it, though they were continually increasing their machinery. They had every confidence that this department would grow into one of the largest and most important cable businesses in the country. The same remarks as he had used in regard to cables applied equally to accumulators. The miners' lamp department would be increasingly important in the future. They had had large contracts from collieries during the past year, and the future opened out with most encouraging prospects. The carbon department was making excellent progress; the orders for the product were more than their machinery could produce, and the orders for their carbon block, especially from manufacturers of motor tires, were alone a big item. The ebonite department was an interesting and growing one. Ebonite and ebonite boxes of all sizes and shapes were in constant demand. With regard to the future, he was filled with optimism. Speaking after long experience, he could not help thinking that notwithstanding all the great evolutions in the science of electricity, the greatest development was still to come in the vast application of the science to the common wants of mankind. The demand for electrical material would increase by leaps and bounds, and fortunes would be made. Their own business was well equipped to meet such a demand, and as their manufactures were essentials, they were bound to have their share of the work. The limit to their output would be fixed only by the amount they could produce. They had more orders than ever before in their history, in spite of the fact that their output to-day was more than double what it was a year ago. The further plant on order would enable them to considerably increase the present output. The balance sheet for the first year of their operations had proved their ability to make satisfactory profits. The speaker went on to refer to the need for further capital and the issue of £200,000 short term notes (7 per cent., free of tax). The new capital would assist in building up the business, and meeting the heavy demands now made upon it.

Birmingham District Power & Traction Co., Ltd.—Mr. C. S. B. Hilton, presiding at the annual meeting on July 13th, said that after putting £10,000 to reserve, and paying a 6 per cent. dividend on the ordinary shares they were carrying forward £4,354. The business had continued to be carried on under extremely difficult conditions. The total expenses reached £308,465, as against an estimated £245,000; the receipts were £349,616, as against an estimated £353,000. Signs were not wanting that trade in the district was beginning to fall in certain industries, and once that took place their receipts would be affected, as tramway receipts were a very good barometer of the condition of trade.

Compania de Electricidad de la Provincia de Buenos Aires.—The directors report that the results for the year ended July, 1919, do not permit of the payment of the preference dividend. The net profit, according to the *Financial Times*, was £54,691, against £40,835 in the previous year. £14,841 was recovered from the Compania Alemana Transatlantica de Electricidad.

Gravesend & Northfleet Electric Tramways Co., Ltd.—Dividend 3 per cent. for 1919; £1,000 to reserve; £4,990 carried forward.

Pernambuco Tramways & Power Co., Ltd.—At the annual meeting on July 15th, Mr. W. Higgins said that the outcome of the year's working was an increase of approximately £21,500 in the net revenue. After placing £23,000 to renewal and reserve, and providing for amortisation, and paying 3½ per cent., free of tax, on the preference shares, £16,900 was to be carried forward. In all the circumstances this position was satisfactory. They had asked the Government for power to raise their rates. Coal which was 33s. per ton delivered at Pernambuco in 1914, now cost at least £8 per ton. Nothing that they used had gone up less than 100 per cent., and many things had risen 300 per cent. The cost of living had also occasioned an appreciable advance in wages. They hoped that the Government would consider their request reasonable. The tramways showed continued development, and the electric light and power branch had great possibilities. They were doing all they could to meet the demand. Their gas undertaking had resulted in a loss, but the number of subscribers to the telephone service in which they held the bulk of the shares, was increasing.

Prospectuses.—*Fuller's United Electric Works, Ltd.*—The list is to close on or before July 26th in an issue at par of £200,000 7 per cent., income tax free, short-term notes, repayable at 105 per cent. in July, 1925. It is stated that owing to the increasing demand for the company's products the present high cost of raw material and the necessity for carrying heavy stocks, further capital can, for the time being, be profitably employed, and this issue of £200,000 is made to repay the bankers' loan (£165,320), and provide further working capital.

Messrs. Johnson, Matthey & Co.—An issue of £250,000 in 8 per cent. notes (seven years) is being offered at 97½ per cent.

Midland Electric Corporation for Power Distribution.—This company is offering until to-day 250,000 ordinary shares of £1 each, these including 120,000 shares held by the British Insulated & Helsby Cables, Ltd.

Vickers, Ltd.—An issue of £1,500,000 7 per cent. seven-year notes has been offered this week, at 95 per cent. It is stated that the proceeds will be used for the extension of the business chiefly in connection with the electrical interests of the company.

Calcutta Electric Supply Corporation, Ltd.—The list is to close to-morrow, Saturday, in an issue of £500,000 5 per cent. first mortgage convertible (registered) debentures, free of income tax. As explained at the recent meeting, capital is needed for the purpose of large extensions and other purposes.

National Gas Engine Co., Ltd.—Interim dividend of 7½ per cent., less tax, on the ordinary shares for the half-year.

Stock Exchange Notices.—The Committee has specially allowed dealings in the following under Temporary Regulation 4 (3):—

India-Rubber, Gutta-Percha & Telegraph Co., Ltd.—750,000 ordinary shares of £1 each, fully paid, Nos. 1 to 750,000; 250,000 5 per cent. cumulative preference shares of £1 each, fully paid, Nos. 1 to 250,000.

English Electric Co., Ltd.—146,036 6 per cent. cumulative preference shares of £1 each, fully paid, Nos. 552,529 to 698,564; and 90,000 ordinary shares of £1 each, fully paid, Nos. 1,431,510 to 1,521,509.

The following are to be officially quoted:—

Brush Electrical Engineering Co., Ltd.—210,488 ordinary shares of £1 each, fully paid, Nos. 1 to 210,488.

Stewarts & Lloyds, Ltd.—82,500 deferred shares of £1 each, fully paid, Nos. 1,700,001 to 1,782,500.

Norwegian Electro-Chemical Works.—The report of the directors of the Norska Elektrokemiskverke, A.S., which covers a period of 15 months, ended with March 31st, 1920, deals at length with the work of the subsidiary undertakings in which the company is interested. It states that the activity of these companies, including hydroelectric works, ore and smelting works, engineering works, cellulose works, and trading companies in Norway, Finland, Russia, &c., was greatly influenced by the difficult conditions in industry. It was necessary to write off 2,989,000 kr. on the Russian investments, and including this sum the total amount written off was 9,500,000 kr., of which 8,000,000 kr. was transferred from the reserve fund. The report mentions that an office was opened in London during the year.

Barnsley & District Electric Traction Co., Ltd.—The *Financial Times* states that the dividend is 12 per cent.; £1,500 to reserve; £10,324 carried forward, subject to E.P.D.

St. James's & Pall Mall Electric Light Co., Ltd.—Interim dividends at the rate of 7 per cent. per annum on the preference and 7 per cent. per annum on the ordinary shares for the half-year.

STOCKS AND SHARES.

TUESDAY EVENING.

THERE is a fair amount of investment business doing in most of the Stock Exchange markets, and throughout the House a steady tone prevails in spite of the holiday influence, which becomes more pronounced the closer that August approaches. It is said that people want to keep their money for holiday expenses, and for paying the additional railway rates which are threatened, but the stockbroker knows that in spite of

the adverse influences at work, there is a proportion of his clients who continue to put away money. Were it not for the new issues which come out so freely, prices of existing investment stocks would most likely be standing higher. But it is impossible to expect any improvement in values so long as really good shares can be bought to pay 8 per cent. and more. The talk of cheaper money is not unlikely to be realised, and this should have a quickening effect upon prices, though if the Bank Rate were to be reduced, the general understanding at present is that the banks would maintain their present tight hold upon credits, and would refuse to provide the financial facilities which so many industrial companies and firms are in want of at the present day.

Of the new issues made within the last week, Fuller's United Electric Works, Ltd., offered at par £200,000 7 per cent. income tax free short-term notes, repayable at 105 on July 31st, 1925. The company was formed about 16 months ago to amalgamate four concerns, and the original business dates back to 1875. The profits of the companies are not set out in the prospectus, but a dividend at the rate of 10 per cent. has been declared for the first year of the company ended March 31st last. The security for the notes is well covered; the company offers a high rate of interest—taking redemption into account—for the money.

The Midland Electric Corporation for Power Distribution has offered 250,000 ordinary shares of £1 each at par, being the balance of the company's authorised ordinary share capital of £400,000; there are also 200,000 7 per cent. cumulative preference shares already issued. The ordinary shares may earn big dividends in the future, but the present-day investor requires, and receives, so many tempting offers that he looks for handsome returns from the outset. As, of course, this issue may provide.

Calcutta Electrics 5 per cent. tax free debenture stock, at 95, looks modest in the matter of yield compared with some of the other recent issues, but the security is admirable, and the right of conversion into shares is certainly valuable. The underwriting commission was 2½ per cent. Bournemouth and Poole 7½ per cents. are said in the market to have been taken only partially by the public.

By all the storm that is raging at the present time round the question of railway fares, the Stock Exchange market for the stocks is scarcely disturbed. The rise in rates is bound to come sooner or later, according to the market theory, and from the merely financial point of view, it matters little whether the change is made a month earlier or later, although the over-taxed father of a family regards it in a different light altogether. Metropolitans are a point higher at 22, and Underground Electric income bonds have started to recover from their heavy fall. The price has rallied to 56½. In our price-lists we leave the dividend for 1919 as 4 per cent., but as the company has passed the interim dividend in respect of the past six months, the yield, of course, is a blank for the time being.

Electricity supply shares show no changes at all, for the second week in succession. There is, however, a fair amount doing in Westminster ordinary, and the shares are changing hands on the basis of 4¼-5½. The market in City ordinary is still overhung by the small block of shares which recently came in, but which are steadily being disposed of at about 21s. 6d. As soon as the parcel is finished, it would not be at all surprising to see City Lights recover to the extent of a shilling or two, because at the present price they are certainly cheap, and the financial position of the company is sound. Brush Electrical Engineering ordinary shares are quoted for the first time as £1 shares, the price being 22s. 6d. Edmundsons 6 per cent. cumulative preference changed hands the other day at 28s., and the 6 per cent. non-cumulative preference at half-a-guinea. The company's 4½ per cent. debenture stock is quoted ex dividend, and can be bought at about 60½, at which the return on the money comes to £7 8s. 10d. per cent. London Electric ordinary have been done this week at 23s. 9d., and the 4 per cent. debenture stock at 75½. Many rises have taken place this week in the various dollar securities of the American utility companies. Changes of this sort are automatic, being made in accordance with the rate of exchange, and having no necessary relation to actual business, which in the ordinary way is extremely limited in these stocks. Cities Service common has risen to 422, and the fractions are quoted rather less. Shawinigan Water 5½ per cent. first bonds are 96, and the common shares 125½. Victoria Falls ordinary keep firm at 11s. 6d., and the preference are 18s. 3d. ex dividend. The 5 per cent. first mortgage debentures are attracting investors on the basis of 91, and there is little going on also in the 5 per cent. second mortgage debentures at about 97. Prices of these issues are better owing to the strength shown by the South African mining market, in consequence of this week's rise in the price of gold.

The position in Mexico is still uncertain, and, in consequence, the market in the various utility stocks is uncertain. Mexican Light preferred shares have gone back to 25½. Mexico Tramway Common shares have receded to 18½, but the bonds are 1 higher at 39. For the 6 per cent. second mortgage a seller obtained no more than 27 a few days ago. The last time that these bonds received any interest was exactly six years ago, and the last payment on the company's first mortgage bonds was made in September, 1914.

Marconis are ex 8s. 6d. dividend, less tax, and 5s. bonus paid free of tax, the market valuing the net payment at 7s. 2d. per share. The price is a trifle lower allowing for this, at 3, and Canadians have receded a few pence to 9s. 9d., but on the other hand, Marines touched 1 13-16 before going back to 34s. 6d. The cable market is hard. Eastern Extensions recovered their dividend of 5s. and Eastern ordinary the 50s. taken off the price last week. Globes, however, ex 14s. are lower 14½. Western Telegraphs were, of course, ex dividend at the end of June. Chili Telephones improved to 6½. Orientals are ¼ better at 2 7-16. There is not much doing in the new shares, but Eastern Telegraph partly-paid are 11s., Eastern Extension £5, and Western 5½. The new Globe shares are about 5¾. The fully-paid shares in each case stand about £8 higher, except in the case of Eastern Telegraph fully paid, which are £1 shares, now at 26s.

In the market for manufacturing shares, Cromptons are 19s. 6d. xd., and Edison-Swan have gone back a trifle to 24s. 4½d. General Electric ordinary at 30s. 6d. are also ex dividend, as are Telegraph Constructions at 20½. There is nothing much doing in this section, which is, of course, peculiarly susceptible to the competition from new issues. India-Rubbers are 25s. 9d. Rubber shares are no better, in spite of the confident prophecies being made as to the probability of a rise in the raw stuff. It is said that a failure took place recently in New York, and the resulting realisation of the raw rubber involved has caused the price to sag. Armament shares are better. The recent weakness has been superseded by a certain amount of support from the North, and the new issues of Vickers and Armstrongs had the unusual effect of making prices better instead of operating in the other direction.

SHARE LIST OF ELECTRICAL COMPANIES.

	Dividend 1918.	Dividend 1919.	Price July 20, 1920.	Rise or fall.	Yield p.c.
HOME ELECTRICITY COMPANIES.					
Brompton Ordinary	8	12	6½	—	£9 8 2
Charing Cross Ordinary	4	7	3½	—	10 0 0
do. do. do 4½ Pref.	4½	4½	2½	—	8 8 8
Chelsea	3	4	2½	—	8 0 0
City of London	8	10	1½	—	6 17 10
do. do. 6 per cent. Pref.	6	6	17/-	—	7 1 2
County of London	7	8	5½	—	9 17 6
do do. 6 per cent. Pref.	6	6	8½	—	7 5 5
Kensington Ordinary	6	7	4	—	8 15 0
London Electric	Nil	2½	1½	—	6 0 0
do. do. 6 per cent. Pref.	6	6	9	—	10 0 0
Metropolitan	5	6	2½	—	10 8 8
do. 4½ per cent. Pref.	4½	4½	2½	—	8 0 0
St. James' and Pall Mall	10	12	6½	—	8 16 10
South London	6	6	3½	—	9 13 0
South Metropolitan Pref.	7	7	18/9	—	7 9 0
Westminster Ordinary	8	10	8½	—	9 15 2
TELEGRAPHS AND TELEPHONES.					
Anglo-Am. Tel. Pref.	6	6	79½	—	7 11 2
do. Def.	22/6	1¼	17½	—	8 11 5
Chile Telephone	5	6	6½	+ ½	*4 16 0
Cuba Sub. Ord.	7	7	8½	—	*8 4 8
Eastern Extension	8	10	144xd	+ ½	*6 18 0
Eastern Tel. Ord.	8	10	148½	+2½	*6 17 6
Globe Tel. and T. Ord.	8	10	14½xd	— ½	*6 18 0
do. do. Pref.	6	4	5xd	—	7 1 2
Great Northern Tel.	22	22	21½	—	10 4 8
Indo-European	13	10	30	—	8 6 8
Marconi	25	25	3½xd	— ½	6 6 8
Oriental Telephone Ord.	10	12	2⅞	+ ⅛	*4 18 4
United R. Plate Tel.	8	8	7	— ½	*6 14 4
West India and Panama	1/8	Nil	1¼	+ ¼	Nil
Western Telegraph	8	10	15	—	*6 13
HOME RAILS.					
Central London Ord. Assented	4	4	44½	—	8 19 9
Metropolitan	1	1½	29	+ ½	5 13 8
do. District	Nil	Nil	15½	+ ½	Nil
Underground Electric Ordinary	Nil	Nil	1¼	—	Nil
do. do. "A"	Nil	Nil	4 6	—	Nil
do. do. Income	5	4	56½	+2	—
FOREIGN TRAMS, &c.					
Anglo-Arg. Trams. First Pref.	Nil	5½	81xd	+ ½	7 17 2
do. do. 2nd Pref.	Nil	Nil	2½	—	Nil
do. do. 5 Deb.	5	5	53½	—	8 11 0
Brazil Tractions	Nil	Nil	47½	+1	Nil
Bombay Electric Pref.	6	6	12	—	4 10 0
British Columbia Elec. Ry. Pfce.	5	5	56½xd	—	8 17 0
do. do. Preferrred	2½	5	53½	—	9 7 0
do. do. Deferred	Nil	3	54½	—	5 10 1
do. do. Deb.	4½	4½	65	+1	7 14 7
Mexico Trams 5 per cent. Bonds	Nil	Nil	39	+1	Nil
do. 6 per cent. Bonds	Nil	Nil	29	—	Nil
Mexican Light Common	Nil	Nil	14	—	Nil
do. Pref.	Nil	Nil	25½	−2	Nil
do. 1st Bonds	Nil	Nil	48	—	Nil
MANUFACTURING COMPANIES.					
Babcock & Wilcox	15	15	95	—	*5 14 4
British Aluminium Ord.	10	10	1⅞	—	9 8 2
British Insulated Ord.	19½	15	1¼	—	8 5 6
Callenders	25	15	1⅞	—	11 6 6
" 6½ Pref.	6½	6½	18/-	—	7 4 5
Castner-Kellner	20	17	3	—	5 13 4
Crompton Ord.	10	10	19/6xd	—	10 5 2
Edison-Swan, "A"	10	10	1⅞	—	8 4 0
do. do. 5 per cent. Deb.	5	5	78½	—	6 5 9
Electric Construction	10	10	1	—	10 0 0
Gen. Elec. Pref.	6¼	6¼	18/6	—	7 0 5
do. Ord.	10	10	30/6xd	—	*5 11 9
Henley	25	15	1¼	—	8 0 0
do. 4½ Pref.	4½	4½	8½	—	6 12 6
India-Rubber	12	10	25/9	—	*7 15 4
Met.-Vickers Pref.	—	6	2½	—	7 2 8
Siemens Ord.	12	12	20/-	—	*7 18 10
Telegraph Con.	20	20	20½xd	— ½	*5 17 0

* Dividends paid free of Income Tax.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

The "One Lever" Automatic Telegraph Transmitter.

A new automatic telegraph transmitter was demonstrated for the first time recently by Mr. F. S. S. Wates, of the Automatic Telegraph Co., 132, Charing Cross Road, W.C.2. The instrument has many interesting features, and has been designed particularly to enable pilots of aircraft to transmit definite wireless messages with a minimum of time and trouble, thus doing away with the necessity of carrying a telegraphist. The instrument may, of course, be applied to other than aircraft work, and its feature is that its operation entails no knowledge whatever of electricity, the Morse code or telegraphy. Fig. 1 shows the outside as well as the inside

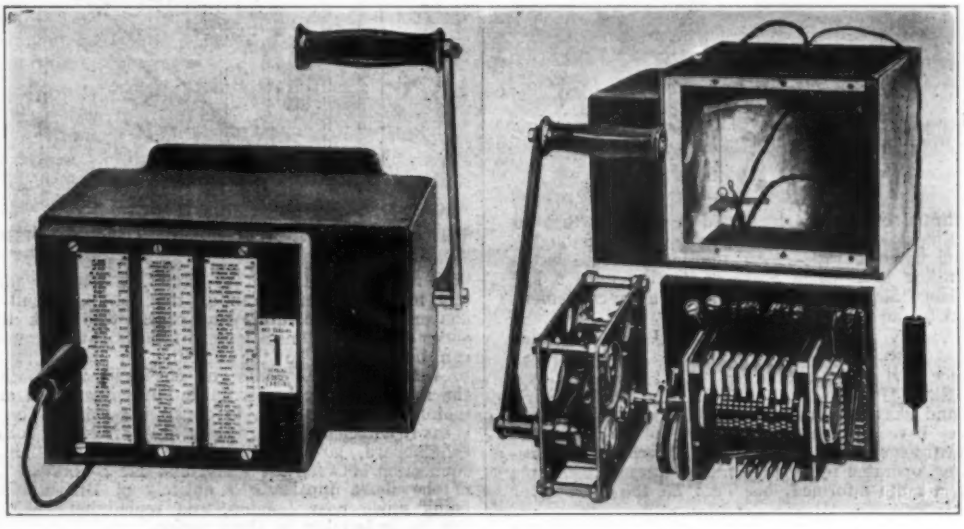

Fig. 1.—"One Lever" Automatic Wireless Telegraph Transmitter.

appearance of the instrument, which weighs about 10 lb. On the face of the box is a plate engraved with 60 messages in three columns. All the operator has to do is to insert a plug in the hole corresponding to the message he wishes to transmit, and to pull down the lever shown at the side of the instrument. This winds up a spring which drives a clockwork mechanism, which in turn rotates a cylinder. A series of contacts arranged round the drum transmits in Morse the call sign of the sending station and the signal representing the message selected. In every case the whole of the message is automatically repeated to make sure that it is received correctly. All the 60 messages are in code, the meaning of which may, of curse, be altered to suit requirements. The call sign of any particular instrument is capable of easy alteration. It is not proposed to receive by wireless, but only to transmit, and the instrument described, which was exhibited at the Aero Exhibition, Olympia, takes the place of the Morse tapping key only, the rest of the circuit remaining the same as usual.

The Gallagher-Crompton Baffle Bridge, and Boiler Efficiency Calculator.

The following particulars refer to a patent baffle bridge for steam boiler furnaces, which has been designed by Messrs. Gallagher & Crompton, of Romiley, near Stockport, with a view to facilitating the use of coke breeze and other low-grade fuels. The use of this bridge tends to materially ease the arduous labour of cleaning fires which is inseparable from the use of such fuel. In addition to fulfilling the functions of an ordinary bridge, it assists the fireman to clean out quicker and without burning the fires down. In the ordinary way, cleaning out (burning down, removing clinker, and getting fires back to normal) generally occupies a considerable period of time. It can be done in a few minutes with the baffle bridge, and, further, cold air is prevented from entering the flues during the operation; it, therefore, saves fuel and prevents loss of steam pressure during the process of cleaning out. The bridge is shown in fig. 2A with the fires in their normal position. As the gases are given off from the fire they are not suddenly restricted, as with the ordinary bridge, but a large combustion space is provided, the passage being more gradually restricted, and projecting blocks provided to assist in mixing the air and gases. The baffle also forms an extended heat radiating surface to assist combustion and radiate heat to the flue gases. Fig. 2B shows the position of the fires when cleaning out. The live fuel is pushed back on to the baffle instead of being burned down, where it is interposed in the passage of the cold air entering the furnace door and passing through the bars, allowing combustion to continue. The whole of the clinker and ash can be removed in one operation, doing away with the necessity of moving the live fuel from one side of the grate to the other, and as a much larger body of fire is left to start up with, the fall in steam pressure is reduced to a minimum. On an evaporation test a saving of 8.81 per cent. was made as a result of using a baffle-bridge furnace, which meant a reduction in coal of 150 tons per boiler per annum; the evaporation was also increased by 13 per cent.

A valuable instrument that is made by the same firm is the "boiler efficiency calculator." This device, somewhat similar to a slide rule, is designed to facilitate the calculation of the thermal efficiency and other data in connection with the running of boiler plant. By its aid the operator is enabled to find the factor of evaporation for any given conditions, without the use of tables, or arithmetical processes, by the simple movement of a scale and chart. A special feature is that this factor can be obtained either for saturated steam or steam superheated to any temperature within the usual limits; the same simple movements only being required in

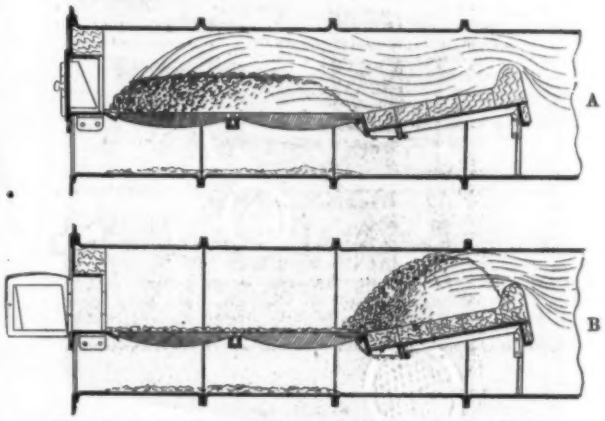

Fig. 2. A and B.—Gallagher-Crompton Boiler Baffle Bridge.

either case. The factor being obtained, the equivalent evaporation from and at 212 deg. F., and the efficiency of the plant can be worked out by moving a second sliding scale. Thus, by four movements of scales and chart, the efficiency can be arrived at accurately, without recourse to steam tables or mathematical formula. The increased efficiency due to utilising the waste heat in flue gases by the use of economisers, or that due to superheating the steam, can also be worked out.

A New Ignition Coil.

Bearing all the appearance, externally, of a magneto but at the same time employing the coil ignition principles, the "Magniter" (fig. 3), being placed on the market by the Vulco Manufacturing Co., 397, Wightman Road, Hornsey, N.8, has a number of advantages claimed for it. In the first place, its design permits it to occupy the position of a magneto without alteration to the chassis. The body being composed of one die casting and stampings reduces the cost of production to half that of a magneto, and the weight to one-third. Revolving

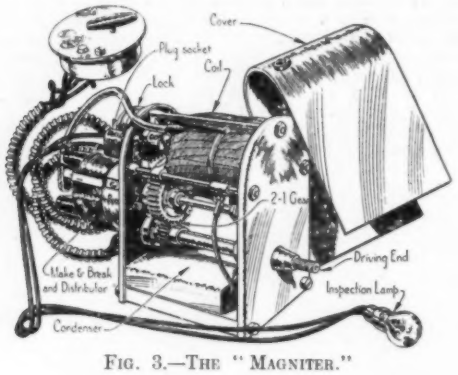

Fig. 3.—The "Magniter."

parts are mounted on ball-bearings, and it is stated that an efficient spark is given at any speed. The device is thoroughly waterproof and is easily timed. An additional feature is the thief-proof ignition lock which prevents starting until a key is inserted. The "Magniter" also provides a more convenient plugging point for an inspection lamp.

An Electric Hair Cutter.

A contributor in a recent article on "Electrical Hair-dressing" (Elec. Rev., May 7th, 1920, p. 580) stated that "electric hair-cutting and shaving machines have not yet been introduced." We have now received a pamphlet from the Commonwealth Edison Co., of Chicago, describing an electric hair cutter, operated by a small motor through a flexible shaft, which, we are informed, has been on the market for four years.

The "Oxford" Portable Kinema Projector.

In our issue of August 1st last year and elsewhere we described a portable kinematograph projector outfit that has found an increasing sphere of usefulness in schools and for other educational purposes. A similar device, but one which is of entirely British manufacture, is about to be put on the market by the Oxford Educational Film Supplies Co., Ltd., of 316, Regent Street, London, W.1. The Oxford projector

Fig. 4.—The "Oxford" Portable Bioscope.

will show a sharply defined picture 10 ft. by 7 ft. 6 in. with a throw of 45 ft., and a smaller picture depending on the distance between the screen and the machine. The device uses standard films, and is claimed to be fireproof; it is simple to manipulate, and may be carried from place to place as easily as a bag. The whole of the apparatus is enclosed in a neat camera-shaped box (fig. 4) 20 in. by 19 in. by 7 in. in size, which is covered with leatherette; the whole outfit weighs only 24 lb. The mechanism, fig. 5, is in two parts, and all bearings are of phosphor bronze; the motor will work on 90 to 110-volt D.C. circuits and up to 60 cycles on A.C. circuits, only 4.5 amps. being required to drive the outfit. If the pressure is greater than 110 volts a small resistance is supplied. The incandescent lamp gives 800 C.P. from a single point of light. A simple attachment is fitted to the machine by means of which the picture can be stopped and held at the will of the operator. Whether the picture is stationary or not the cooling fan which is driven by the motor continues to function, and the speed of the picture can be regulated by means of a slide resistance in the motor circuit. A slide resistance is also provided to control the light given by the lamp, and if not central the picture can be racked by turning a screw on top of the case. The device

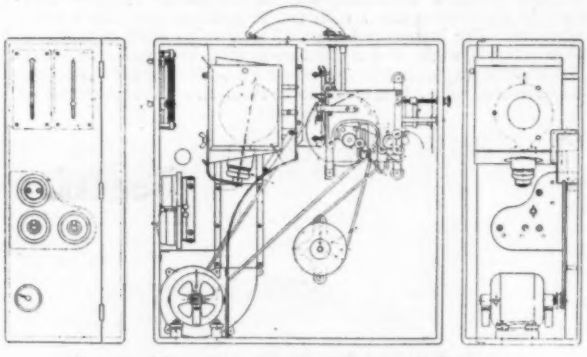

Fig. 5.—Mechanism of the "Oxford" Bioscope.

does not require a separate circuit, it may be plugged into any lamp socket and run off the lighting circuit. For the convenience of lecturers and others who wish to use still slides as well as films a lantern attachment is supplied, which can be attached to the machine or used separately. To provide for places where no electricity supply is available the firm will supply a complete outfit, by which an ordinary motor car can be made to do all the work. The apparatus is easily detachable, and weighs 70 lb.; it consists of a dynamo, switchboard, governor to ensure constant supply, and the connection between the motor and the generator. The whole of the above apparatus is entirely of British manufacture, being made near London, and replacement of spare parts can be undertaken at short notice.

The B.T.H. "Pyrotip" Electric Burner.

The "Pyrotip" electric burner has been designed by the British Thomson-Houston Co., Ltd., Mazda House, 77, Upper Thames Street, E.C. 4, to meet the demand for an economical and convenient means of lead burning, such as is necessary in the repair and construction of lead storage batteries and in other operations involving the welding of lead plates or strips. Essentially it consists of an auto-transformer by which the ordinary supply voltage is reduced to a suitably low pressure, and the current increased in the same proportion.

Ffrom the secondary or low-voltage side of the transformer two heavy rubber insulated cables carry the current to the work. One cable terminates in a spring clip which is attached

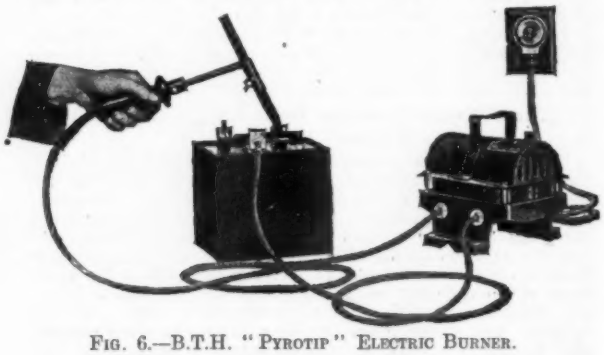

Fig. 6.—B.T.H. "Pyrotip" Electric Burner.

to the metal close to the point where the burning is to be done. The other cable is attached to a holder with an insulated handle, containing a carbon electrode about 8 in. long. The carbon electrode, when the circuit is closed by applying it to the lead, produces an intense heat. One electrode will burn from 250 to 300 joints. The double conductor from the primary side of the transformer is fitted with a 2-pin plug top or adapter, as desired, for connection to a wall socket or lamp holder.

"Pyrotip" electric burners can, of course, only be used on alternating-current circuits, the standard types being made for use on supply pressures of 100-110 volts and 200-240 volts, and for periodicities of 25-49 cycles and 50-140 cycles.

THE TRADE OF CANADA.

[A Review of the Position by H.M. TRADE COMMISSIONERS.]

A BULKY document* (Cmd. 720) of 204 pages has been issued containing a report by Messrs. F. W. Field and L. B. Beale, H.M. Trade Commissioners at Toronto and Winnipeg respectively, on the trade of Canada and Newfoundland for the year 1919. Detailed reports on the trade of Ontario and Western Canada are included.

Naturally it is only in certain parts that the report is of direct electrical interest, but when so many eyes are turned towards Canada as one of the lands offering immense possibilities for the future, so full a review should be of special value to the adventurous and enterprising.

It is not surprising to read that "given more stable political and social conditions than those obtaining at the beginning of 1920," the Dominion should achieve a degree of development far surpassing that achieved hitherto. It is remarked that with her vast resources Canada has reason to hope that in the difficult times ahead she will create sufficient wealth to liquidate her heavy burden of debt and to play a more important part in the world economy. Financial conditions, the exchange situation, natural wealth and income, the area and yield of crops, minerals, railways, and other matters are reviewed, after which it is pointed out that high-tension transmission has been notably developed during the last few years, and has been one of the most important factors in the utilisation of Canadian water powers. There is a total of 5,940 miles of pole line for transmission lines of from 10,000 to 100,000 volts. With regard to immigration, it is expected that agriculture will attract a greater number of people to Canada than any other class of industry. "While the re-building of devastated portions of Europe will occupy the attention and give occupation to a large number . . . many with the wanderlust will seek a country where they may forget the scenes through which they have passed, and Canada will receive many of the most desirable of these." Only desirables will be admitted. Large numbers of an excellent class of settlers are expected from the United States.

There is a section of the report devoted to industrial conditions, and herein we find a good deal of information respecting the manufacturing developments that have occurred since 1914. Among others are the extension measures taken by the Dominion Steel Corporation at Sydney, Nova Scotia, in anticipation of prospective developments. Notes on shipbuilding, pulp and paper, textiles, chemicals, and other departments of industry follow, as does also a section on export trade with statistics of exports for the seven months ended October, 1919. The rise in value of manufactured export goods during the war was due to munitions output, and the figures given since mark the altered conditions following upon the cessation of hostilities, but Canada is to-day an exporter of many manufactured lines as the result of industrial activities entered upon during the war, and these activities may be expected to increase. Iron and steel products represent one of the most important groups of imports, embracing as they do everything from the raw ore, through semi-manufacturers, to machinery and hardware of every description.

Mr. Field's report on Ontario Province mentions Ontario as an attractive market for British manufactures, "more especially in the lines in which United Kingdom manufacturers have excelled for so long." The prospect of German and Japanese activity in certain departments is touched upon, and the larger operations which may be engaged in by the United States. The tendency of U.S. firms with trade connections in Canada is to establish separate units there, either branch works, offices, or agencies. The need for studying what patterns of goods are suited to the market is once more urged, also the necessity for supporting to the full Canadian agents, when the right men have been appointed. It is thought that there is an opportunity for increased sales of machinery of various kinds, including air compressors, hoisting machinery, mining equipment, textile machinery, and other lines in which British firms are specialists. Three of our weaknesses are said to be lack of sufficient local representation and active salesmanship, failure to keep in constant touch with users of our machines, and inability to effect repairs and supply spare parts at short notice. It is suggested that unless we remedy these shortcomings the imports of British machinery will become smaller, but the reader should see the report, and study it in detail, if he is interested in this important aspect of trade expansion work. Advice is given to shippers and principals of British exporting firms are recommended personally to visit the market; they will then understand better the difficulties of agents, and give them greater sympathy and support. Water power matters, of course, come in for treatment, but our readers have already had so much information placed before them in these pages in our references to the reports of the Hydro-Electric Commission, that we need not stay to enlarge upon that subject here.

In considering the industrial outlook, the factors which have made for a high level of activity of late are enumerated, and they include orders for railway equipment, steel rails, European reconstruction requirements, road building, resumption of national works interfered with by the war, revival of building trades and mining industry, and general business and trade expansion. The principal uncertainties mentioned are possible labour demands, coal supply, and ocean transportation. There is a "Made-in-Canada" movement. Several new industrial, trade, and engineering organisations have been started.

We quote the following references to electrical equipment and electrical appliances:—

Electrical Equipment.—United Kingdom manufacturers have had difficulty in obtaining business in face of keen United States and Canadian competition, and on account of the difference in standards. British equipment of the smaller types, such as motors and meters, has been sold. There is a growing market for large water turbines and generators, and the United Kingdom firms which propose to specialise in this work should be able to obtain some of the local business. The principal competitors are the United States and Sweden. The following notes about electrical equipment may be of interest to United Kingdom manufacturers.

The enclosed type of switchgear is not used extensively in Canada. Experienced Canadian engineers state that it should be employed in works in which switchgear may be exposed to heavy or careless use by rough or inexperienced labour. The standard lines of small motor control gear and service boxes (the latter of heavy cast iron) made in the United Kingdom are regarded as too cumbersome to suit local practice.

Transformer practice in the United Kingdom and in this market are similar. The principal difference is that almost all United Kingdom manufacturers use paper insulation on the laminations of the core. A somewhat crude method of fusing fuses in pole type transformers is in use here as compared, for example, with that employed in Sweden, which embodies a regular control panel in the upper part of the case. There is no demand in the United Kingdom for pole transformers.

Slip-ring motors are much more extensively used in the United Kingdom than in Canada. Canadian electrical engineers, who have a knowledge of British works, appreciate the finish and durability of motors made in the United Kingdom. Some of the lines are expensive, but are undoubtedly worth the extra cost when compared with those made elsewhere.

Electric meters of United Kingdom manufacture are sold in Canada and have a good reputation. The United Kingdom firms at present catering for this market exhibit considerable interest in their overseas customers.

One of the problems of long-distance transmission systems in Canada is the low-power factor, and in this connection the vibrating phase advancer made in the United Kingdom should be of service.

Electrical Appliances.—Ontario is an excellent market for all kinds of electrical appliances such as electric irons, washing machines, stoves, heaters, grates, hot plates, toasters, chafing dishes, coffee percolators, house radiators, and desk fans. The present sales are substantial, but the demand is rapidly expanding. In some of these electrical lines particularly, firms in the United Kingdom should be able to secure a satisfactory volume of business, if proper attention is given

* H.M. Stationery Office, 1s. 6d. net.

to local representation. Generally speaking, the finish of Canadian and United States appliances is superior to that of those from the United Kingdom.

Local experts consider that the best developed electric appliance in the United Kingdom is the electric grate or fire. With an adequate sales policy, this line should be sold extensively in Canada. Several Ontario buyers have obtained samples of the British grates.

The domestic electric cooking stoves made in the United Kingdom are not as attractive to the Canadian buyer as those made on this continent. The heavy cast-iron frame is not suitable for this market. The prices ruling in this market are from $100 to $150, which are considerably lower than the United Kingdom prices. The development in large electric cooking devices for factory canteens and public institutions is regarded by Canadian experts as notable. The prices of the United Kingdom manufacturers, in this instance, are generally lower than those of this continent.

The system of concentric wiring being developed in the United Kingdom should prove of interest, in the larger sizes, to Canadian buyers for use in connecting electric ranges.

There is a substantial and expanding market here for electric irons. The United Kingdom products are higher in price than the American, and the finishes are inferior. A much lower wattage is in use in the United Kingdom than in Canada.

There is a substantial demand for porcelain electrical fittings. These were imported before the war largely from Austria. In view of the rapidly increasing use of electric current by Ontario these lines are worthy of serious consideration by United Kingdom manufacturers.

The main report by Mr. Field, from which we have quoted at length, is followed by others from Mr. Beale, at Winnipeg, who deals with the trade of the Western Provinces, and from Imperial trade correspondents in Nova Scotia, New Brunswick, Quebec, Alberta, and British Columbia (Victoria and Vancouver). There are also a number of tabular appendices.

ELECTRIC FURNACE DEVELOPMENT.

AT the annual congress of the Society of Chemical Industry, at Newcastle-on-Tyne, on July 14th, a paper by Mr. D. F. Campbell, M.A., A.R.S.M., upon "Recent Developments of the Electric Furnace in Great Britain" was read by Mr. Burton, in the absence of the author.

The writer said that in no branch of metallurgy had greater advances been made during the war than in the development of iron and its alloys, giving them materials of extraordinary strength and physical properties. Steel for aero-engine parts owed its power and lightness to the addition of small percentages of metals, the aeroplane wire its strength, and bullet-proof steel its toughness to the addition of suitable alloys, such as those of nickel, chromium, molybdenum or manganese, and the electric furnace had been responsible in most cases, for both the reduction of those refractory metals from their ores, and the subsequent manufacture of alloy steel.

Electric melting, he pointed out, had enabled them to use advantageously the vast quantities of steel turnings from shell factories. The remelting of nickel-chrome steel was a wasteful and most difficult process in all other furnaces, but the reducing conditions and absolute control of the electric furnace made it possible either to retain, or remove, at will, most of the chromium, and thus large quantities of a valuable metal were saved. The economic manufacture of stainless steel had been rendered possible only by the electric furnace which was required both for the preparation of the refined ferro-chrome and steel melting.

In 1914, the power used by electric furnaces in Britain, excluding those used for aluminium, was probably less than 6,000 H.P., but on the day of the armistice the total was in excess of 150,000 H.P. The production of electric steel had reached a total of more than 200,000 tons per annum. The manufacture of large quantities of phosphorus by electric furnace methods was necessary during the war, and the excellent fused silica ware for laboratories and chemical works made with such remarkable success on the Tyne, was, perhaps, the most interesting example of the use of the electric furnace for fine work.

Electric furnaces owed their value to their intense reducing conditions, as they utilised the only practical source of heat that did not require oxygen for its generation.

The utility of the electric furnace did not cease at the end of the war. Shops equipped with electric furnaces for war purposes had been re-constructed, and were producing alloy steels. The manufacture of artificial graphite, a new industry to this country, had been established, and electrodes of a size and quality equal to the best in the world were being produced, and the manufacture of alloys and amorphous electrodes was being developed along the lines of present requirements. The next immediate development would, probably, be the general application of electric smelting to the treatment of complex zinc ores.

On July 5th a visit was paid by the members of the Society to the works of the Newcastle Alloy Co. at Rowlands Gill. Dr. H. Piele, chairman of the company, mentioned that the works were originally established to utilise some of the waste heat from the adjoining coke ovens, which was used to generate steam for the turbines in the generating station. During the war the Ministry of Munitions had looked to the company to provide the whole of the country's requirements of ferro-chrome. Since the war the company had been reorganised, and special attention was being given to the production of the low carbon ferro-chrome used in the manufacture of stainless steel. Three large Heroult furnaces had been erected, and a plant had recently started at Blaydon for the production of amorphous carbon electrodes for electric furnaces.

THE ELECTRICAL APPARATUS INDUSTRY OF CANADA.

(FROM A CORRESPONDENT.)

IT is, of course, well known that the Dominion of Canada is in the forefront of those countries in which the utilisation of electricity, and particularly hydro-electric power, has been carried to a high degree of development, and information which has just been published by the Dominion Bureau of Statistics at Ottawa would appear to indicate that the manufacture of electrical apparatus has also reached important proportions in Canada, the requirements of the various electrical plants being very largely met by Canadian manufacturers rather than by importation from abroad.

The information in question is contained in a preliminary report issued by the Bureau of Statistics and containing figures compiled for the year 1918, since which date there is little doubt that considerable progress has been made by the manufacturers in order to comply with the demands upon them in connection with the numerous developments of water power which are now going on all over Canada. In 1918, however, there were in operation in the Dominion some 68 plants for the manufacture of various descriptions of electrical apparatus. Of these 42 were in Ontario, 13 in Quebec, seven in Manitoba, three in British Columbia, two in Alberta, and one in Saskatchewan. The total capitalisation of the industry was $43,235,405, and some 8,863 persons were employed at wages and salaries aggregating $8,456,705. The quantity and selling value at the works of all articles produced during the year under review is given in the following table:—

	Quantity.	Selling value at works.
Dynamos, generators, and converters ...	14,249	$1,503,443
Transformers...	193,904	2,291,874
Switchboards, panel boards, and cabinets...	—	990,898
Motors, all kinds	115,111	2,727,673
Storage batteries	262,514	212,624
Primary batteries	4,869,468	1,397,635
Incandescent lamps	3,601,288	1,525,198
Incandescent lamps (number not specified)	—	399,547
Sockets, receptacles, bases, &c.	—	415,855
Electric lighting fixtures, all kinds ...	—	311,844
Telegraph apparatus	—	71,230
Telephone transmitters	26,175	50,000
" receivers	56,750	95,000
" interior systems...	46,478	444,000
" central switchboards	37	750,000
" private exchange boards ...	323	110,000
Insulated wire and cable	—	5,154,984
Electrical machinery, all other	—	1,738,085
Carbons	—	1,362,666
All other miscellaneous products	—	8,492,843
Total selling value		$30,045,399

Canadian exports of electrical apparatus during the past fiscal year ended March 31st last amounted to only $301,932 (of which $159,788 was for batteries, telephone and telegraph apparatus, and $142,144 for electrical apparatus, not otherwise provided for), which total is a decrease from $2,167,545 in 1918-19 and $2,166,961 in the previous year. Imports of dynamos, generators, and motors, however, increased from $1,917,861 in 1917-18 and $2,353,722 in 1918-19 to $3,020,742 during the past fiscal year, when the figures were $1,976,703 for motors and $1,044,039 for dynamos and generators, the business being almost entirely in the hands of United States firms. Incandescent electric lamps to the value of $1,335,016 were also imported last year, nearly all from south of the international boundary line, and other imports during the past fiscal year included electric insulators of all kinds, $614,523; sockets, $142,748; telegraph instruments, including wireless apparatus, $114,034; telephone instruments, $653,517; transformers, $124,356; primary electric batteries, $124,833; electric storage batteries, $1,474,724; electric cooking and heating apparatus, $112,152; electric light fixtures or parts thereof of metal, $732,020; electric meters, $280,868; and electric apparatus, not otherwise provided for, $7,435,239.

VARIABLE-SPEED, SHUNT-WOUND D.C. MOTORS.

Flash-over Tendencies and Iron Losses.

A USEFUL analytical treatment of the flash-over tendencies and iron losses of variable-speed, shunt-wound D.C. motors is given by F. Niethammer in a recent issue of *Elektrotechnik u. Maschinenbau*, from which the following abstract is prepared :—

The speed of shunt motors may be varied economically and over a range of 1 : 6 by varying the main field ϕ, fig. 1, this being accomplished by varying the field current $I_e = E/(R_e + R_r)$. At the lowest speed n_0, the flux ϕ_0 is a maximum, and so is the field current $I_{e0} (= E/R_e)$. At maximum speed n_1, the field is a minimum ϕ_1, and is produced by a field current $I_{e1} = E/(R_e + R_{r1})$. Commutating poles W are generally employed to produce at all

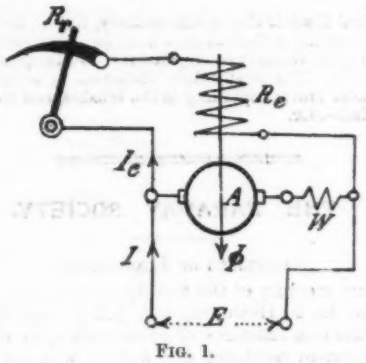

FIG. 1.

loads a voltage e_w, compensating for the sum of the reactance voltage e_x and the cross-field voltage e_q, which increase proportionally with the speed. At high speed n with weak main field and heavy load on the machine there is danger of flashing-over, owing to the high potential difference between commutator segments whilst between brushes of opposite polarity. Referring to fig. 2, the main field H in the air gap combines with the armature cross-

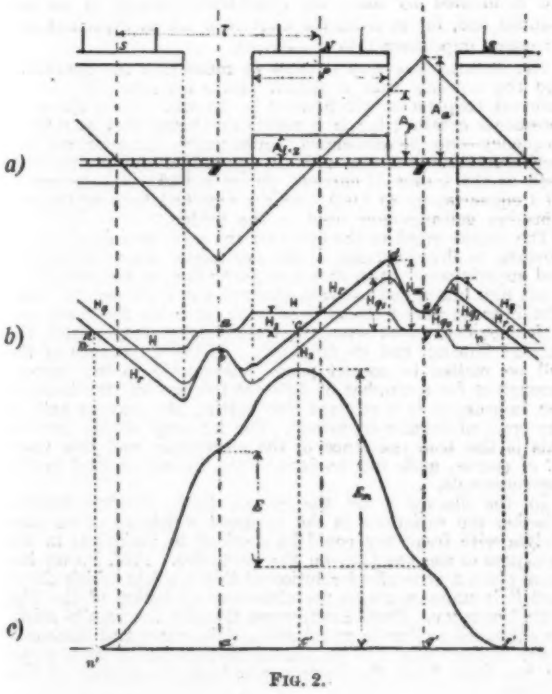

FIG. 2.

field H_q to produce a resultant field H_r, the maximum value of which is H_m. Then, neglecting the small ohmic drop, the maximum segment voltage is—

$$e_m = (p/a) \times H_m \times l_i \times v \times (z/K) \times 10^{-8} \quad \ldots \quad (1)$$

where $2p$ = number of poles ; $2a$ = number of parallel branches ; l_i = armature length in cm., exluding air ducts ; v = peripheral speed of armature in cm./sec. ; z = number of armature conductors ; K = number of commutator segments. The same expression with the substitution of H_d for H_m gives the mean voltage per segment, where H_d = mean field strength per pole pitch between two sets of brushes. H_d is approximately equal to $H_1 P/\tau$, where H_1 = max. value of main field H ; and p/τ = pole arc/pole pitch. We have then—

$$e_m = e_d \times H_m/H_d = (2p E/K) \times H_m/H_d$$

where E = terminal voltage. Again, $H_m = H_1 + H_{q1}$; and $(4\pi/10) A_{1+z} = H_1 \delta a_0$; and $(4\pi/10) A_p = H_{q1} \delta a'_0$; where A_{1+z} = ampere-turns per pole for air gap and teeth. Other relationships are :—$A_p = A_a P/\tau$; $A_a = I_a z/8ap$ = armature ampere-turns per pole ; I_a = armature current ; a_0 (approximately equal to a'_0) is the addition to the reduced air gap δ for the iron ampere-turns in the armature iron.

There is obtained thence the important result :—Max. voltage per segment—

$$e_m = (2p E/K) \times [\tau/p + A_a/A_{1+z}] \quad \ldots \quad (2)$$

As the speed is increased, A_{1+z} becomes smaller, but A_a remains constant at full load.

In order that flashing be avoided, e_m may not exceed a maximum of 30 to 40 volts. Now, P/τ is practically fixed at $\frac{1}{2}$ to $\frac{2}{3}$, and eqn. (2) indicates the following means of avoiding flash-over :—(*a*) Increasing the number of segments K ; (*b*) Reducing the armature reaction A_a ; (*c*) Increasing the field ampere-turns A_{1+z}. The risk of flashing is, of course, greater, the higher the terminal voltage E, but this factor is fixed in any particular case.

Considering each of the means (*a*), (*b*), (*c*) above, the maximum number of commutator segments K is determined by the breadth of segment $b = \pi D_k/K$, which must not be less than 4 or 5 mm. ; and by the commutator diameter D_k, which must be somewhat smaller than the armature diameter D, and must correspond to a reasonable peripheral speed (preferably below 20 to 30 m/sec.). The armature reaction A_a increases with the number of segments K as the number of turns per segment is reduced, thus the two effects neutralise each other to some extent. We have $A_a = \tau A/2$, where $A = I_a z/2a\pi D$ = ampere-conductors per cm. of periphery (AS). Thus A_a cannot be made as small as one chooses, because A must be

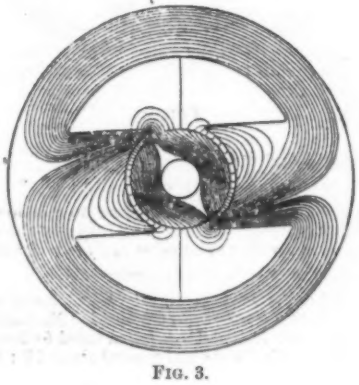

FIG. 3.

200-300 if the machine is to be an economical design. Finally, the field ampere-turns A_{1+z} is increased by using a long air-gap δ and high tooth saturation. Considerations of stray field limit the gap length to 5-10 mm.

The two main desiderata for variable-speed motors are thus a large number of commutator segments and a long air-gap.

Mechanical means of reducing the risk of flashing are to undercut the mica between segments (the undercut surfaces being lacquered) and to use from 1 to 2 mm. of mica between the segments.

It should be noted that, owing to the armature reaction, the voltage E_m (fig. 2) is considerably greater between the points *c f* than the terminal voltage E between adjacent brushes *a g*. We have, in fact :—

$$E = 2f \times (z/2a) \times l_i \times \tau \times 10^{-8} \times F_0$$

F_0 being given by the area of *g e d c b a*, and $E_m = 2f \times (z/2a) \times l_i \tau \times 10^{-8} \times F_m$ when F_m = area *f h e d c*. Hence :—

$$E_m/E = F_m/F_0 \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

In fig. 2 the surface integrals $\int H_x\,dx$ are taken successively from *a* to *f*, thus including both the terminal voltage E and the maximum voltage E_m.

Taking $H_{q1} = m H_1$ and $H_{q0} = H_{q1}/v$ we have, if the H_r — curve (fig. 2) be built up of straight lines :—

$$E_m/E = 1/2 + 1/2m + (\tau/2P) \times (m + m/v - 1) - m/2v \ldots (4)$$

In the extreme case, when $m = 4$, $v = 4$, and $P/\tau = 2/3$ we have $E_m/E = 3\frac{1}{2}$.

In other words, there exists between the points *c f* on the commutator, *more than three times the terminal voltage of the machine.*

The highest potential difference between segments is then : $e_m = e_d (1 + m) \tau/P = 7\frac{1}{2} e_d$ where e_d = mean potential difference between segments.

The strong field distortion due to armature reaction causes considerable increase in the iron losses of the armature teeth and

armature core, the flux distribution in the case of a 2-pole motor being as in fig. 3. The expression for the iron losses in the teeth and core is :—

$$P_{h+w} = f(\sigma_h B^2_z V_z + \sigma^1_h B^2_k V_k) + f^2 \Delta^2(\sigma_w B^2_z V_z + \sigma^1_w B^2_k V_k) \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

where the subscripts z, k refer to the teeth and core, and h, w refer to hysteresis and eddy currents respectively ; B = max. induction ; V = volume ; $f = n\,p/60$ = frequency ; Δ = plate thickness in mm. ; and σ, σ' = constants of the material.

On light load, B_z and B_k are proportional to H_l, but on load they are proportional to $H_m = H_l + H_{ql}$, hence the ratio of the iron losses P_h on load to those P_o on light load is (at given speed) :—

$$P_h/P_o = [1 + (H_{ql}/H_l)]^2 \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

The iron losses at full load with weak field may easily be from 10 *times as great as on light load.*

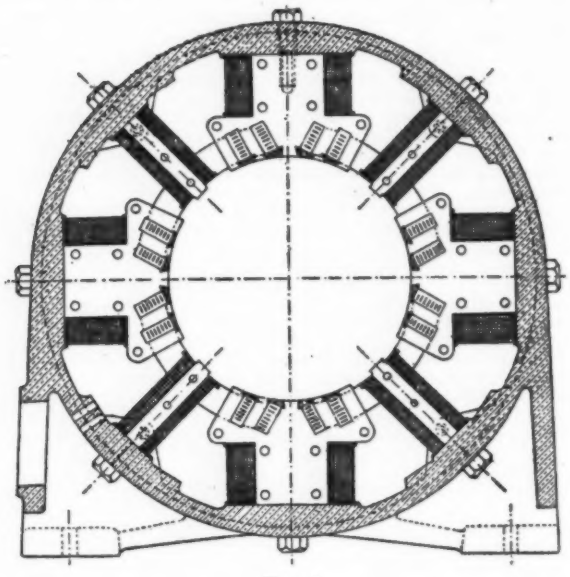

FIG. 4.

Eqn. (5) may be written :—

$$P_{h+w} = (\sigma_h f + \sigma_w f^2)(H_l + H_{ql})^2 \quad \ldots \quad (7)$$

Then, H_l being the field corresponding to the lowest speed n_o, and the maximum speed n_1, being $\lambda\, n_o$, it can be shown that (with $H_{ql} = m\,H_l$ at the lowest speed ; $\sigma_h = \sigma_w f$; $m = \frac{1}{2}$; and $\lambda = 6$) :—

$$P'_h/P'_o = 9 \text{ approximately,}$$

i.e., at full load and maximum speed, the iron losses are nine times as great as on light load at minimum speed. Similarly, the ratio of the iron losses at full load and maximum speed to those at full load and minimum speed is (in the above case) about 4·2 : 1.

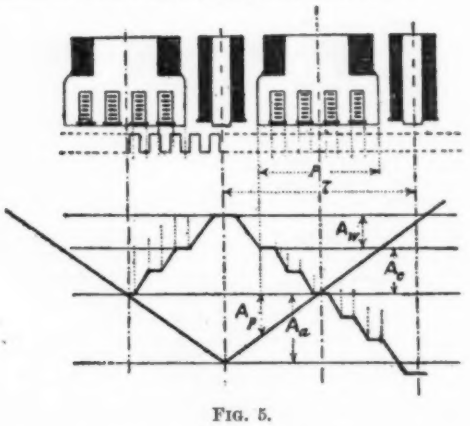

FIG. 5.

This means that if the iron losses are 3 per cent. at the minimum speed, they increase to 13 per cent. at maximum speed (on full load in each case), so that *the motor efficiency falls from, say, 90 to 80 per cent.*

Since the armature reaction operates as an oscillation of double frequency $2f$, it would be more accurate to write eqn. (7) :—

$$P_{h+w} = (\sigma_h f + \sigma_w f^2)(H_l + 2\,H_{ql})^2 \quad \ldots \quad (7a)$$

which corresponds to yet more unfavourable conditions for the high speed n_1.

In addition, the pole shoe loss is increased quite considerably at the higher speed, especially at the pole tip where the high induction H_{ql} is operative. Again, high values of H_m involve high tooth densities which, in turn, lead to high induction in the slot in the radial direction of the slot depth. This causes considerable eddy-current losses in the copper conductors, apart from the losses due to current displacement through the cross field of the slot.

For all of these reasons, the heavy field distortion by the armature reaction causes a serious reduction in the efficiency of variable-speed shunt-wound motors.

There is, however, a very simple means of compensating for the armature reaction, eliminating its injurious effects, and preventing flashing-over. This is accomplished by fitting cross-coils, as in fig. 4. The compensating ampere-turns A_c are made $= A_p = A_a\,P/\tau$ (fig. 5). In addition, one adds to the interpole ampere-turns A_w so that $A_c + A_w = 1.2$ to $1.3\,A_a$. Then $H_{ql} = D$ (approx.) and $H_m = H_l$, so that e_m is much reduced (see eqn. (1)). Eqn. (2) for the maximum voltage per segment then becomes :—

$$e_m = e_d \times H_l/H_d = 2\,p\,E/K \times \tau/P \quad \ldots \quad \ldots \quad (8)$$

In general—

$$e_m = (2\,p/K) \times E\,[\tau/P + (A_p - A_c)/(P\,A_l + 2/\tau)] \ldots \quad (9)$$

and when the desired condition $A_p = A_c$ is fulfilled, eqn. (9) reduces to eqn. (8).

The General Electric Co., of Schenectady, U.S.A., builds variable-speed, shunt-wound motors as shown in fig. 4, for outputs of from 2 to 125 H.P., and states expressly that the losses are thereby reduced by 10 per cent. The heavy field distortion is avoided, the commutating poles prevent sparking at the brushes, and the cross coils eliminate flash-over.

THE FARADAY SOCIETY.

RESISTANCE OF ELECTROLYTES.

AT the June meeting of the Society an important paper was read by Dr. H. F. HAWORTH, who put forward a method of obtaining the true resistance of an electrolyte, by disentangling from its apparent resistance that portion of it due to electrode effects. The usual method of so doing is the well-known Kohlrausch method, by which alternating current is employed and the resistance of the cell balanced in the ordinary way with the Wheatstone bridge, using a telephone as indicator instead of a galvanometer. In the first place, as pointed out by Dr. Haworth, true balance is never obtained in this way, and indeed it cannot be obtained except at one particular frequency. Secondly, the assumption that the electrode effects are eliminated by using an alternating current is an unfounded one, for in truth the electrodes act as capacities and introduce impedance into the circuit.

The method described consists in measuring the resistance and the capacity with a special bridge arrangement at two different frequencies which must be known. From the measurements obtained the true resistance—being that at infinite frequency—can be calculated. Alternative methods are described in the paper, and so is the specially-designed alternator used as the source of current, giving a true sine current at all frequencies up to 1,000, and the modified form of Duddell vibration galvanometer used in the bridge.

The results point to the fact that the resistance as measured consists, as already stated, of the electrolytic resistance proper, and superimposed upon that a capacity due, it is assumed, to a gas film interposed between electrodes and electrolyte. This film behaves like a leaky condenser, and its thickness and resistance depend on strength of electrolyte, temperature, the current flowing, and its frequency. If the impedance of the cell be plotted in correct phase relationship to the current through it for a number of different frequencies, the locus of the impedance is a straight line cutting the current axis at the point of infinite frequency. The intercept on the current axis is the true resistance of the electrolyte, and this value is, of course, quite independent of the frequency used in the measurements.

In the discussion on the paper, Prof. PORTER doubted whether the variations in the apparent resistance of an electrolyte with frequency could be ascribed to variations in the thickness of the gas films on the electrodes. Prof. Porter has since given a generalised solution of this problem which shows that it is unnecessary to postulate any alteration of the film with frequency. Prof. PARTINGTON thought the results might be explained as due to polarisation. The paper and discussion made it clear that the question is more complex than would be imagined from the current text-book knowledge of this subject.

THE CONDUCTION OF ELECTRICITY THROUGH FUSED CAUSTIC SODA.

An experimental paper on this subject by Dr. A. FLECK and Mr. THOMAS WALLACE, with accompanying discussion, showed that many people's—be they chemists or physicists—ideas on conduction through fused electrolytes are even at this time of the day not so clear as one would expect. The experimental work of the authors of this paper is both timely and useful; they give us reliable measurements—made on a works scale with laboratory precision—of the conductivity constants of fused caustic soda, namely, specific resistance, variation with

temperature, decomposition voltage, and so forth. They showed surprise, however, to the surprise of their critics, that the resistance between these electrodes was not quite constant when the distance between them became large compared with their size, and they inferred that fused caustic soda did not behave exactly as the dissolved salt—in other words, did not obey Ohm's law on account of some residual electrode effect. This result would be of considerable interest if it were conclusively proved, but Dr. Fleck did not succeed in convincing his audience that his anomalous results were not due to the comparative smallness of the containing vessel.

ELECTROLYTIC CHLORATE FORMATION.

The theory of the electrolysis of the alkali chlorides to yield chlorates and perchlorates has exercised the ingenuity and knowledge of electrochemists for the past twenty-five years. Mr. N. V. S. KNITTS and Mr. H. PALFREMAN have approached the subject as practical manufacturers, that is to say, their theories are based on data obtained from large-scale electrolytic operations. It does not mean that their work is either rough and ready or unscientific. Indeed it is singularly careful and methodical, and it can be safely said that their present contribution to an important branch of applied electrochemistry is the most important made since the classic work of Foerster and Müeller. Apart from the value of the theoretical discussion, the data given in their paper will be of considerabe value to those responsible for the technical control of the processes under consideration.

The experimental portion of the paper contained conductivity measurements of the solutions of sodium chloride, chlorate, and perchlorate, such as they occur mixed in practice; a dynamical study of the hyperchlorite to chlorite reaction; and a description of the determination of the resistance and electrode potentials of technical chlorate and perchlorate cells. For these results and a discussion of the deductions made from them reference must be made to the full paper.

On the theoretical side, the electrochemistry of chlorite formation was very clearly set out by the authors. When a solution of sodium chloride is electrolysed in a cell in which the two electrodes are close together, sodium hypochlorite is formed. It results from the liberation of chlorine at the anode, and its reaction with hydroxyl ions to form hypochlorous acid,

$$Cl_2 + OH' = HOCl + Cl'$$

and a solution of chloride will at first evolve chlorine until there is a sufficient concentration of hydroxyl ions present to enable this reaction to proceed at the necessary velocity. The hypochlorite concentration will continue to increase until other reactions, electrochemical or chemical, which decompose it, have increased to such an extent that the rate of decomposition is equal to the rate of formation by the current. The decomposition of the hypochlorite is attributed mainly to (1) discharge of hypochlorite ions at the anode with formation of chlorate and liberation of oxygen, $6ClO' = 3H_2O = 2HClO_3 + 4HCl + 3O$, and (2) reaction of hypochlorite irons with free hypochlorous acid to form chlorate, $OCl + 2HOCl = ClO'_3 + 2HCl$.

It will be seen that, since oxygen is liberated in reaction (1), the formation of chlorate by this process is necessarily attended by loss of efficiency, and it may easily be shown that the maximum attainable is 66.6 per cent. Moreover, there is reason to believe that other reactions between the discharged hypochlorite ion and water take place which result in the liberation of an even larger quantity of oxygen, and that these reactions predominate at elevated temperatures. The second reaction, on the other hand, is purely chemical, and involves no loss of oxygen, and therefore no loss of efficiency. On this account it is the one selected for the production of chlorate technically.

The authors proceeded to discuss the possible sources of loss of efficiency in the hypochlorite-chlorate transformation, and they arrived at the conclusion that it is due to the discharge of hypochlorite ions and at constant temperature proportional to their concentration. An equation was then developed to express the efficiency in terms of temperature and other controlling factors, and finally reference was made to methods designed to keep up the efficiency by maintaining hypochlorous acid concentration.

The reactions leading to perchlorite formation were similarly discussed. It would take us too far afield to go into the somewhat complex processes involved. Suffice it to say that the authors' experiments support generally Oechsli's theory that the perchlorite is formed as a result of chlorate ion discharge at the anode, but that the actual reactions which take place are the following :—

(1.)—$O_3Cl - + OClO_3 = O_3Cl - O - OClO_3$.

(2.)—$O_3Cl - O - O - ClO_2 + HOH = O_3Cl - O - H + O_2ClOH$.

(3.)—$O_3Cl - O - O - HO_2ClOH$.

An understanding of this mechanism leads to a discussion of the factors that determine the technical efficiency of the process and the amount of energy absorbed.

Among other papers also presented at the same meeting were the following :—

"The Measurement of Electrical Conductivity in Metals and Alloys at High Temperatures," by Mr. J. S. HAUGHTON.

"Sorption of Iodine by Carbon," by Mr. J. B. FIRTH.

"Electrolysis of Sodium Nitrate," by Mr. F. H. JEFFERY.

ELECTRICITY SUPPLY AT SHANGHAI.

THE annual report of Mr. T. H. U. Aldridge, M.I.E.E., engineer-in-chief and manager of the Shanghai Municipal Council Electricity Department, is always interesting; few undertakings have progressed with such phenomenal rapidity, and in spite of his continued efforts to forestall the demand, Mr. Aldridge has constantly been chasing it—mainly owing to the delays in delivery of new plant resulting from various causes. The new Riverside power station, which was opened in 1913, was fully described in the ELECTRICAL REVIEW of November 5th, 12th, and 19th, 1915; it then contained plant of 14,000 KW., in addition to the 6,000-KW. plant at Fearon Road, and the annual output was 50 million units. In January, 1919, a 5,000-KW. Fraser & Chalmers-Vickers turbo-alternator was put to work, and the two A.E.G. 2,000-KW. sets, repaired at Nagasaki, were restarted in the autumn. Both the 5,000-KW. A.E.G. sets again broke down badly during the year at a most unfortunate time, when another set was being overhauled. The erection of a new 10,000-KW. Parsons set, and the first of two 18,000-KW. American sets, was commenced in 1919, and two trunk cables between the generating stations were put in operation at 22,000 volts, having previously been used at 6,600 volts. A 3,500-K.V.A. Westinghouse synchronous condenser was put into service, and its success in improving the power factor led to the placing of an order for a duplicate machine. A G.E.C. 6,500-K.V.A. synchronous condenser was also delivered. The total generating capacity at the end of last year was 38,600 KW., with 46,000 KW. in course of erection. The maximum load was 28,365 KW., and the load factor was 42.39 per cent. The total output was 102 million units, which is exceeded by only four British municipal undertakings, none of which has a load factor of 33 per cent.; the output showed an increase of 18.6 per cent., mainly due to the power load. House service connections increased by 2,870 to 27,903; 108.75 miles were added to the overhead cable system, and 18 miles to the underground cables. Transformers installed in sub-stations increased by 16,000 KW. to 50,000 KW., and there were in all 73 sub-stations and 11 pole transformer stations. Several large mills were connected, and many more are being built. The undertaking has 824 motors on hire, and a total of 2,093 motors connected, of 33,000 H.P. Intensive industrial activity followed the cessation of the war, the full effect of which is still to be developed; the prospects of Shanghai as an important industrial centre are exceedingly encouraging. The demand for hired heating and cooking apparatus exhausted the supply of radiators, of which 1,672 are in service, with 79 cookers.

The net profit for the year, after providing Tls. 519,256 for depreciation and Tls. 442,152 for interest, was Tls. 386,326.

Mr. Aldridge's programme of extensions for the next three years (dated December 22nd, 1919) contemplated a demand of 64,000 KW. in 1921 and 80,000 KW. in 1922. Unless two more 18,000-KW. machines were ordered very soon, he said, the position in 1921 would be as critical as in 1919.

He recommended the extension of the power station during 1921 with two 18,000-KW. sets, making a total capacity of 101,000 KW., together with two house turbines of 5,000 KW. each; the safe load would then be 78,000 KW., and the estimated load 64,000 KW. In 1922 the whole of the A.E.G. plant would be removed, and the total capacity increased to 122,000 KW.

Orders have been placed for a good deal of plant, including eight boilers of 640,000 lb. total normal evaporation per hour, of the B. & W. and Stirling types, B.T.H. 22,000-volt switchgear, and 40 miles of 0.2 sq. in. 22,000-volt split-conductor armoured cable from the British Insulated & Helsby Cables, Ltd. Hitherto trunk feeders of 5,000 KW. have been used, but in view of the greatly increased demand, feeders of 7,500 K.V.A. are to be used in future.

Mr. Aldridge expects to sell about 300 million units in 1922, and to have a load factor, in a few years, of 45 per cent.

Whilst he is in England he will call for tenders for two 18,000/20,000-KW. turbo sets, coal-conveying plant, and various other items.

NEW PATENTS APPLIED FOR, 1920.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. SEFTON-JONES, O'DELL AND STEPHENS, Chartered Patent Agents, 285, High Holborn, London, W.C.1.

18,244. "Arrangement for excitation of continuous-current generators." F. Krupp Akt. Ges. July 2nd. (Germany, January 6th, 1915.)

18,335. "Electrical welding electrodes." British Thomson-Houston Co. (General Electric Co.). July 2nd.

18,373. "Cable conduits." F. J. Aubrey. July 2nd.

18,387. "Electrically-operated switch machines and interlocking system for railways." W. H. Simms. (General Railway Signal Co.). July 2nd.

18,407. "Telephonographs." Telegraphon Ges. July 2nd. (Germany, July 17th, 1919.)

18,412. "Dynamo-electric machines." H. Charlet. July 2nd.

18,430. "Switches for electric bells, &c. T. B. Sharp. July 3rd.

18,442. "Electric welding apparatus." R. F. Woodburn. July 3rd.

18,444. "Electro-mechanical starting and operating from a distance." R. Mautsch. July 3rd. (Belgium, April 10th, 1914.)

18,482. "Telephone exchange systems." Western Electric Co. July 3rd. (United States, December 29th, 1916.)

18,486. "Apparatus for electric transmission of motion." R. Jokasch and K. Schember. July 3rd. (Austria, July 11th, 1919.)

18,492. "Galvanic batteries or cells." S. Brydon and E. Cummings. July 3rd.

18,508. "Electric switches." R. J. Capener and A. V. Rose. July 3rd.

18,544. "Pendant electric light fittings." W. Broadbent. July 5th.

18,567. "Dynamo-electric machines." Electromotors, Ltd., and E. Greenhalgh. July 5th.

18,578. "Incandescent electric lamps." W. J. Cameron. July 5th. (United States, February 14th, 1916.)

18,579. "Illuminating attachment for retractors." W. J. Cameron. July 5th. (United States, May 4th, 1916.)

18,584. "Electrical accumulators." C. Saunders and Saunders Electrical Co. July 5th.

18,607. "Electric signalling." L. de Forest. July 5th. (United States, April 17th, 1919.)

18,608. "Electric lamps." A. Zöller. July 5th. (Germany, November 7th, 1913.)

18,627. "Electrically inducing chemical action." W. J. Rickets. July 5th.

18,641. "Telephone systems." Western Electric Co. July 5th. (United States, June 14th, 1919.)

18,642. "Method of coating metallic articles." Western Electric Co. July 5th. (United States, September 20th, 1916.)

18,643. "Radio-transmission system." Western Electric Co. July 5th. (United States, October 2nd, 1916.)

18,644. "Telegraphic ciphering and deciphering mechanism." Western Electric Co. July 5th. (United States, September 13th, 1918.)

18,652 & 18,656. "Radio-signalling." Radio Corporation. July 5th. (United States, January 6th, 1916.)

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18,654/5. "Wireless signalling apparatus." Radio Corporation. July 5th. (United States, April 5th, 1915.)

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18,661. "Vacuum valve detectors." Radio Corporation. July 5th. United States, March 10th, 1917.)

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18,687. "Electric switches." Eureka Vacuum Cleaner Co. July 5th. (United States, January 18th, 1917.)

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18,691. "Electric controllers." Entz Motor Patents Corporation. July 5th. (United States, July 18th, 1917.)

18,702. "Electric arc-welding apparatus." Siemens-Schuckertwerke. July 5th. (Germany, July 4th, 1919.)

18,718. "Electric steelyard weighing-machine." R. Joksch & K. Schember. July 5th. (Austria, July 8th, 1919.)

18,726. "Means for connecting electrical conductors." H. A. Whitehead. July 5th.

18,748/9. "Sparking plugs." J. E. Temple. July 5th.

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18,798. "Telephone sub-station circuits." Western Electric Co. July 6th. (United States, September 9th, 1916.)

18,799. "Wireless signalling systems." Western Electric Co. July 6th. (United States, December 1st, 1915.)

18,810. "Electric-ignition plugs." Michigan Spark Plug Co. July 6th.

18,831. "Starting and stopping devices for electromotors of pumps, &c." Hundt & Weber Ges. July 6th. (Germany, July 8th, 1914.)

18,832. "Electric relays." A. Orling and Orling's Telegraph Instruments Syndicate. July 6th.

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18,838. "Line telegraphy." Siemens & Halske Akt. Ges. July 6th. (Germany, December 18th, 1918.)

18,843. "Insulating material and body composed thereof." Champion Ignition Co. July 6th. (United States, August 22nd, 1917.)

18,844. "Spark plugs." Champion Ignition Co. July 6th. (United States, September 25th, 1918.)

18,845. "Spark plugs." Champion Ignition Co. July 6th. (United States, November 22nd, 1917.)

18,849. "Portable electric welding apparatus." Siemens-Schuckertwerke. July 6th. (Germany, May 3rd, 1919.)

18,860. "Electric ship compasses." Siemens & Halske Akt. Ges. July 6th. (Germany, December 16th, 1918.)

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18,883. "Electric switches, &c." C. J. Margerison and F. J. Shenton & Co. July 6th.

18,892. "Electro-magnetic appliance for handling plates, &c." Colville & Sons and J. J. Inglis. July 6th.

18,895. "Devices for showing telephone numbers." O. T. Smith. July 6th.

18,909. "Electrical resistances." J. Erskine-Murray. July 6th.

18,910. "High-frequency signalling." Western Electric Co. July 6th. (United States, March 3rd, 1916.)

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18,912. "Telegraph ciphering and deciphering mechanisms." Western Electric Co. July 6th. (United States, December 4th, 1918.)

18,913. "Telegraph ciphering and deciphering mechanisms." Western Electric Co. July 6th. (United States, December 9th, 1918.)

18,929. "Sparking plugs." S. L. Collins. July 6th.

18,938. "Protective devices for electric alternating-current distributing systems." J. H. Bowden, H. A. Carney, Johnson & Phillips, and H. F. J. Thomson. July 6th.

18,939. "Transmission of electric current impulses." Petra Akt. Ges. für Elektromekhanik. July 6th. (Germany, March 13th, 1919.)

18,940. "Receiving radio signals." J. L. Hogan. July 6th. (United States, November 27th, 1916.)

18,957. "Method for reducing overtalking and overhearing in long-distance two or four wire circuits." Siemens & Halske Akt. Ges. July 6th. (Germany, March 22nd, 1919.)

18,958 & 18,959. "Electric furnaces." P. de Miles. July 6th. (United States, January 25th, 1918.)

18,970. "Inductors or field magnets for magneto-electric machines." C. von der Weid. July 6th. (Switzerland, June 12th.)

18,977. "Transformer of three-phase currents to constant direct current." O. M. Corbino. July 6th. (Italy, May 26th, 1917.)

18,978. "Dynamo-electric machines." C. Macmillan. July 6th. (United States, May 31st, 1917.)

18,987. "Vacuum fuse for electric circuits." F. Schröter. July 6th. (Germany, January 29th, 1914.)

18,991. "Electrical discharge valve." F. Schröter. July 6th. (Germany, January 23rd, 1918.)

18,992. "Transformation of polyphase currents." O. M. Corbino. July 6th. (Italy, July 28th, 1917.)

18,998. "Wireless receiving systems." E. H. Armstrong. July 6th. (United States, October 29th, 1913.)

18,999. "Electric discharge tubes." G. Seibt. July 6th. (Germany, October 24th, 1913.)

19,004. "Transformer for measuring electric currents." Compagnie pour la Fabrication des Compteurs et Materials d'Usines à Gaz. July 6th. (France, June 30th, 1919.)

19,005. "Transformers for measuring electric currents." Compagnie pour la Fabrication des Compteurs et Materiels d'Usines à Gaz. July 6th. (France, June 26th, 1914.)

19,006. "Rheostat-transformers with adjustable transformation ratio and phase difference." Compagnie pour la Fabrication des Compteurs et Materiels d'Usines à Gaz. July 6th. (France, May 8th, 1919.)

19,009. "Electron discharge devices." General Electric Co. and M. Thompson. July 6th.

19,020. "Galvanic batteries and electric lamps." R. Ziegenberg. July 6th.

19,052. "Electric pushes." E. A. Graham. July 6th.

19,054. "Current motors." J. J. Rebman. July 6th.

19,063. "Modulation systems for wireless signalling, &c." Radio Communication Co. and J. Scott-Taggart. July 6th.

19,068. "Sparking plug, &c." H. F. Tierney and G. H. Ward. July 7th.

19,080. "Electric lamp controlling apparatus." F. E. Clipstone and Falksley, Ltd. July 7th.

19,089. "Combination wall plug and socket and pendant ceiling fitting." T. P. Pollitt. July 7th.

19,094. "Electric heating." J. Lightfoot. July 7th.

19,104. "Pneumatically-operated electric switches." F. Bushrod and W. J. Thorrowgood. July 7th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will be printed and abridged, and all subsequent proceedings will be taken.

1918.

21,276. "Systems for driving hoists, rolling mills and electric locomotives." Vickers, Ltd., C. F. Mackness and H. H. Broughton. December 19th, 1918. (144,742.)

1919.

827. "Means for fixing a magneto brush-holder to a gear wheel." H. de la Valette. February 27th, 1918. (123,724.)

4,029. "Thermo-electric apparatus." W. H. Wilson. February 18th, 1919. (Cognate application, 18,612/19.) (144,757.)

5,611. "Apparatus especially useful as relay, oscillograph, telegraph, telephone, automatic current or tension-regulator, and other arrangement sensitive to variations of electrical tensions." K. Rahbek and F. A. Johnsen. March 6th, 1919. (144,761.)

6,195. "Electric heating units and methods of manufacturing the same." British Thomson-Houston Co. (General Electric Co.). March 12th, 1919. (144,767.)

6,342. "Pressure-operated electric cut-outs." H. Frost & Co., W. H. Welch. March 13th, 1919. (144,777.)

6,343. "Electrical cut-outs." H. Frost & Co. and W. H. Welch. March 13th, 1919. (144,778.)

6,353. "Supports or mountings for telephone receivers." E. T. Jones. March 14th, 1919. (144,781.)

6,366. "Electric driving and controlling gear for planing-machines." Electromotors, Ltd., B. Longbottom, and E. Greenhalgh. March 14th, 1919. (144,782.)

6,641. "Brush rocking-gear and terminal mechanism for dynamo-electric machines." H. D. Rohman. March 17th, 1919. (144,800.)

6,642. "Holders for globes, shades and the like for lamps." C. E. Adams. March 17th, 1919. (144,801.)

6,654. "Electrically-heated furnaces." Morgan Crucible Co. and C. W. Speirs. March 17th, 1919. (144,802.)

6,781 "Galvanic batteries." G. & J. Oldham. March 18th, 1919. (144,807.)

10,716. "Manufacture of lead-covered electric cables." A. Olier and P. Rousillon. April 30th, 1919. (144,841.)

10,858. "Means to be employed in the electric welding of iron, or steel, or alloys thereof." A. C. Hyde. May 1st, 1919. (144,842.)

11,483. "Sparking plugs for internal-combustion engines." C. K. Shepherd. May 8th, 1919. (144,849.)

12,081. "System of and apparatus for obtaining and utilising electric energy from a battery." E. L. Terrey. December 13th, 1919. (144,854.)

13,005. "Electric horns." D. V. L. Fellows. August 27th, 1919. (144,860.)

15,476. "Combined electric lamp and alarm clock." N. A. I. Neilson. July 3rd, 1918. (129,287.)

18,436. "Electric insulation testing devices." Dubilier Condenser Co. August 26th, 1918. (131,879.)

19,534. "Electric lighting systems applicable to trains." P. Browne. August 8th, 1919. (144,914.)

19,983. "Electric switch mechanism." Electrical Apparatus Co. and A. J. Martin. August 14th, 1919. (144,915.)

27,530. "Receiving arrangements for electric waves." Siemens & Halske Akt. Ges. June 18th, 1918. (135,177.)

28,877. "Sparking plugs for internal-combustion engines." G. L. Delfosse. November 20th, 1919. (144,957.)

29,056. "Device for indicating the effective sparking condition or otherwise of the plugs of motor road vehicles." T. W. Paterson. November 22nd, 1919. (144,958.)

30,234. "Spark plugs for internal-combustion engines." V. Joly. December 3rd, 1919. (144,962.)

30,702. "Electric bells." A. & J. Veron. December 8th, 1919. (144,964.)

1920.

1,157. "Electric hand-irons." B. H. Francois. March 12th, 1918. (137,846.)

1,973. "Controllers for electric railways operated by means of high-voltage direct current." Akt. Ges. Brown, Boveri et Cie. January 21st, 1919. (138,107.)

2,525. "Magnet coils." Siemens Schuckertwerke Ges. October 19th, 1918. (138,142.)